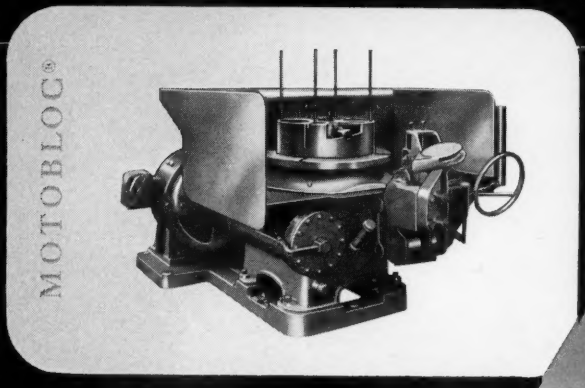
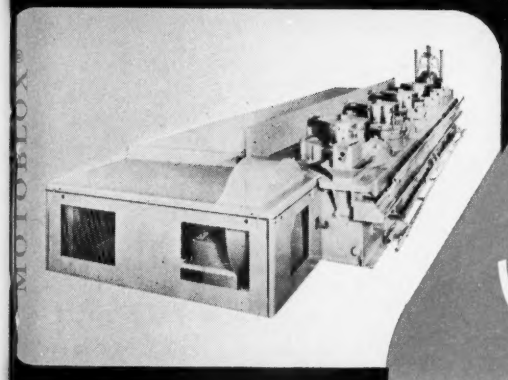
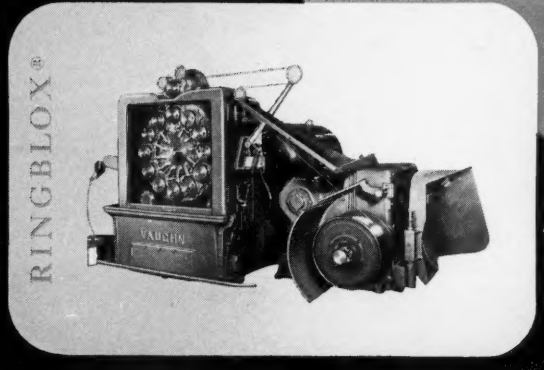
WIRE AND WIRE PRODUCTS

SEPTEMBER 1951







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Wire Drawing Machinery

Check each point of the specific VAUGHN machines designed to handle your types of wire production, and you'll see what we mean . . . the sum total of *superior production ability.*

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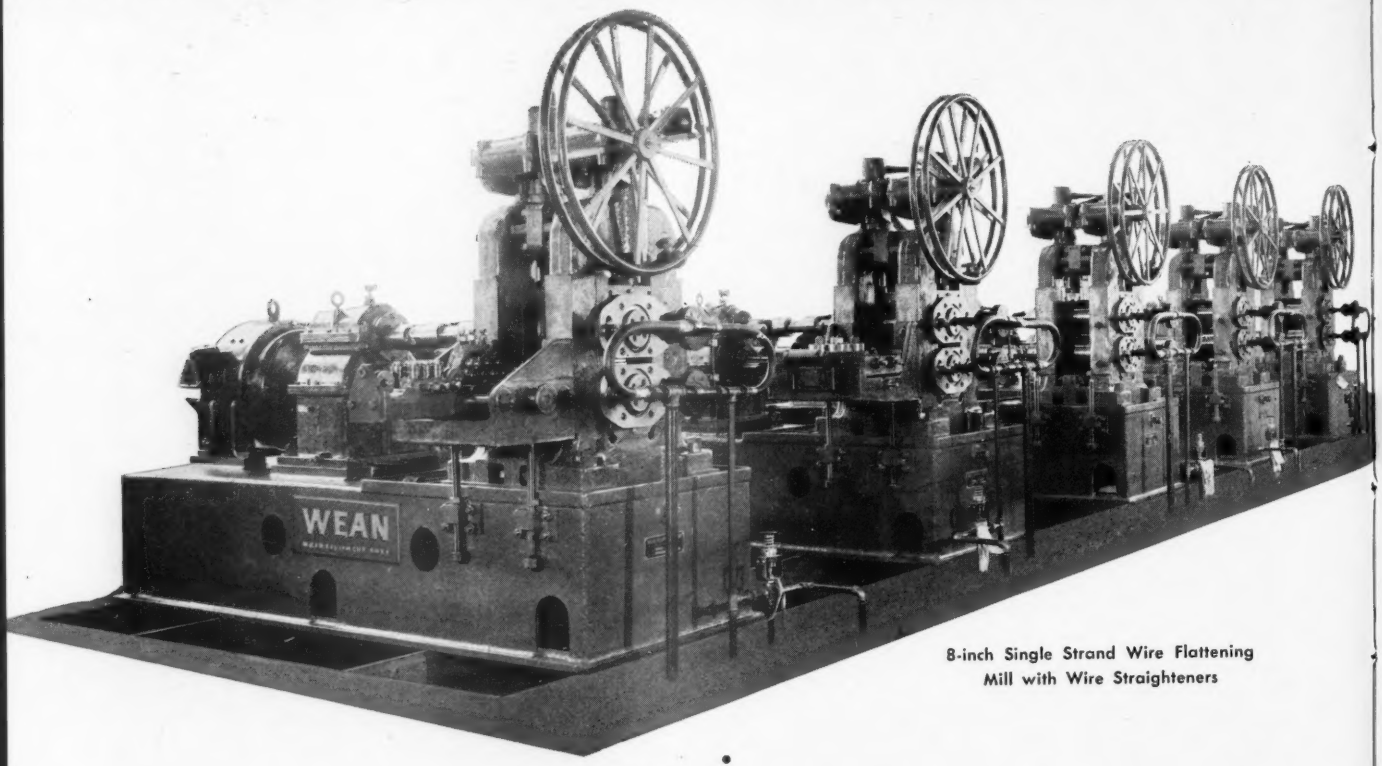

8-inch Single Strand Wire Flattening Mill with Wire Straighteners

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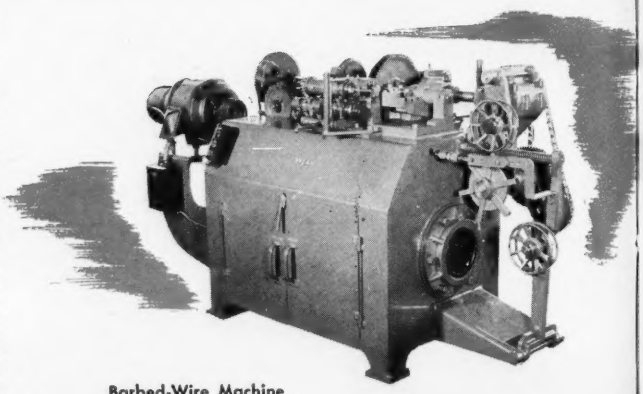
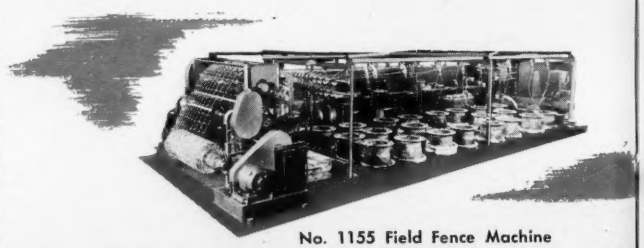


Barbed-Wire Machine

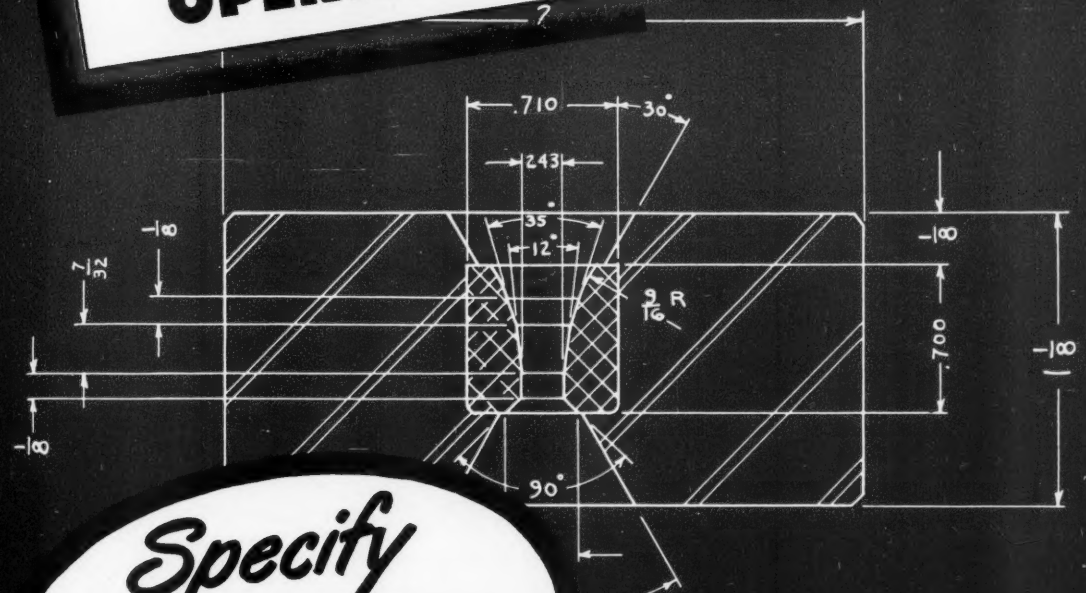


No. 1155 Field Fence Machine

Wean Equipment Corporation

CLEVELAND. OHIO

Memo to: ECONOMY-MINDED WIRE MILL OPERATORS



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FOR: WIRE DRAWING DIVISION	
SIZE: R-6 FINISHED	HOLE: .243
SPECIFY: FIRTHALOY	
DRWG APVD: J. Myers	DATE: 2-21-51
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R-225

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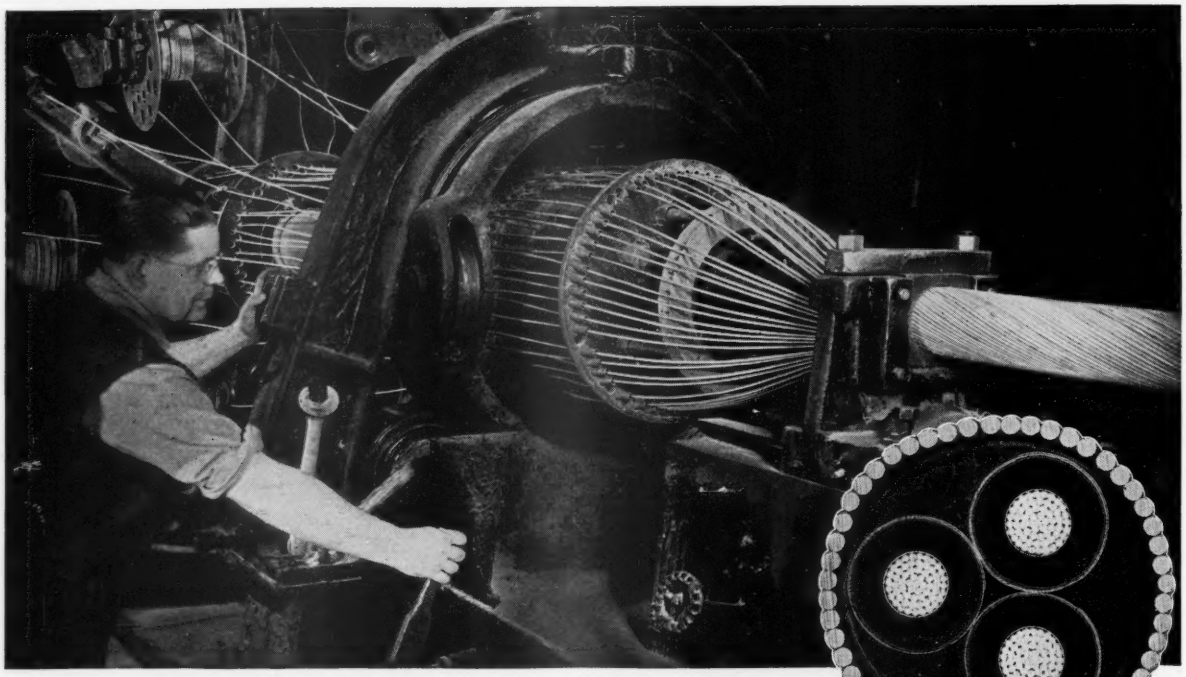

ARMORING MACHINE—The 39,200-ft cable gets its wrap of protective steel as 52 bethanized wires are wound helically in a continuous operation. As each reel of armor wire is used up, the end of the No. 4 gage wire is welded to the end of another length. Nearly 400 miles of armor wire, weighing 177 tons, was required.

BETHANIZED WIRE Armors Largest High-Voltage Submarine Cable

A 25,000-volt power cable, the largest of its kind ever made, was lowered to the bottom of Puget Sound early in May. Capable of transmitting 27,000 hp, it will feed Bonneville electric power to the San Juan island group. Engineered and made in one 7½-mile length by The Okonite Company for the Bonneville Power Administration, the 4.6-in. diameter cable has an armor made up of 52 bethanized steel wires.

The helically wound steel wire greatly strengthens the cable, takes up the stresses incurred in handling, and protects it against damage when submerged.

HUGE RAIL SHIPMENT—Probably the largest item of railroad freight ever handled in one piece, the 375 tons of cable posed quite a shipping problem because of its 7½-mile length. A length of about 4400 ft was coiled in each of the nine gondolas, then the cable was looped over into the next car.

Photos courtesy The Okonite Co., Passaic, N. J.

BETHLEHEM WIRE

INSIDE STORY—The giant power cable, 4.6 in. in diameter, has an outer armor of 52 bethanized wires, each about ¼ in. in diameter. Each of the three stranded copper conductors is insulated with rubber insulation and clad with a metal shielding tape. Spaces between conductors are filled with jute and bound with heavy tape prior to the armoring operation.

The high corrosion-resistance and ductility of the bethanized coating make bethanized wire ideal for a wide variety of uses, especially where long coating life is needed. In the bethanizing process, 99-pct-pure zinc is deposited atom by atom in a uniform, tightly bonded jacket. Twist it, bend it, even draw it through dies—the ductile zinc refuses to crack, flake, or peel off. It's a coating that can take a lot of punishment.

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This month's "STEELSKIN" Planning Conference was devoted to preparing for the ANNUAL WIRE ASSOCIATION CONVENTION, Oct. 22-25.

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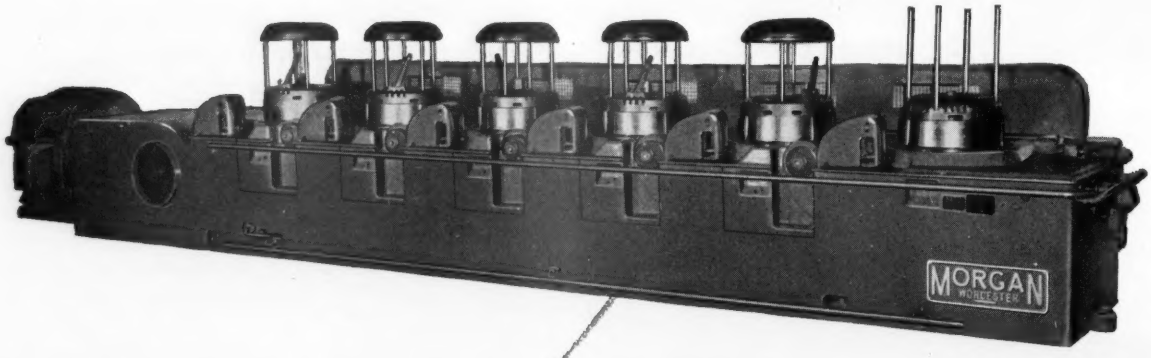

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REGENERATIVE FURNACE CONTROLS
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A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 26 SEPTEMBER, 1951 No. 9

Designated as Official Publication By The Wire Association

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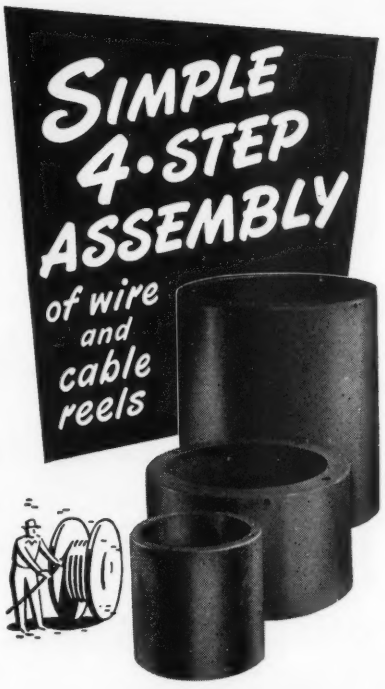

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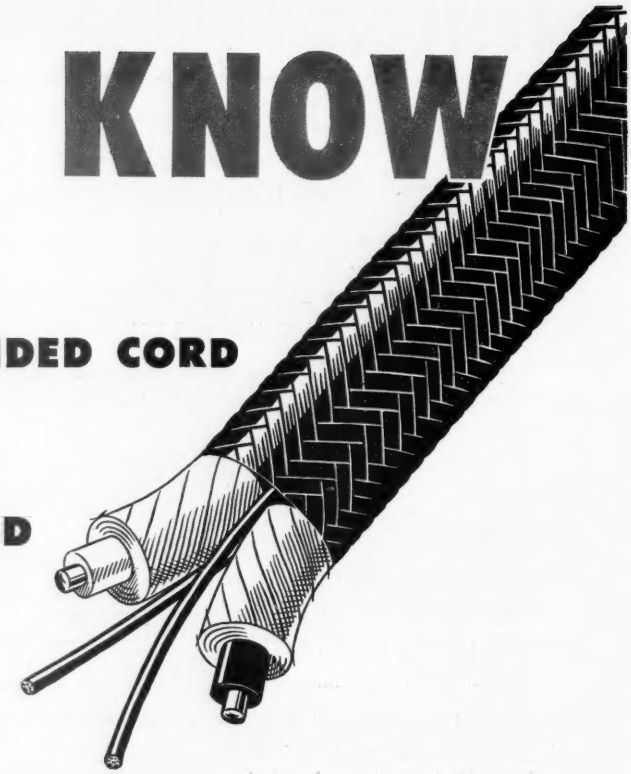
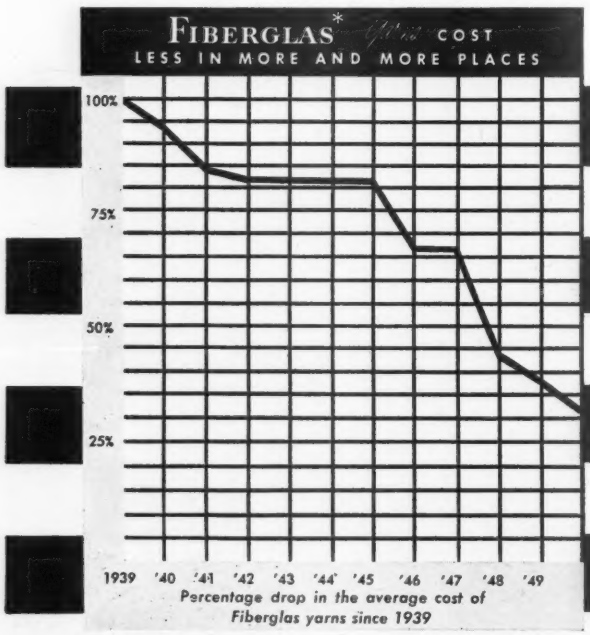


...BECAUSE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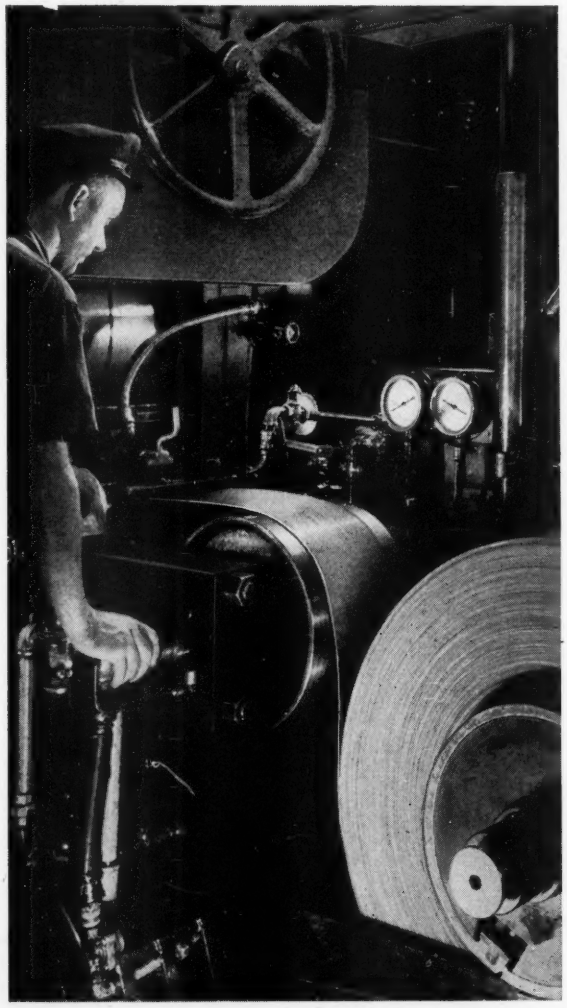

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YOU SAVE MONEY with Roebling Cold Rolled Spring Steel because it's of absolutely uniform quality. Every inch is just like every other inch, dimensionally and in physical properties. Service records show that it cuts down preparation time . . . gives you a better product and better production. And Roebling Cold Rolled is made annealed, hard rolled untempered; scaleless tempered; tempered and polished; tempered, polished and strawed; and tempered, polished and blued.

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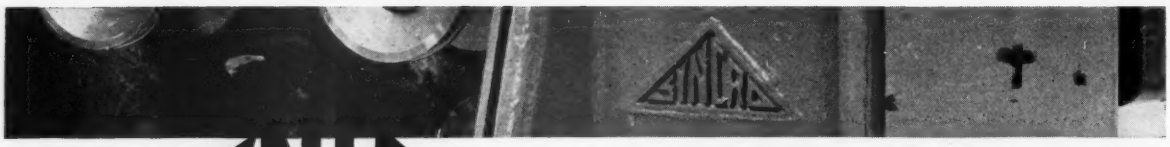

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Vitron® GLASS FIBER

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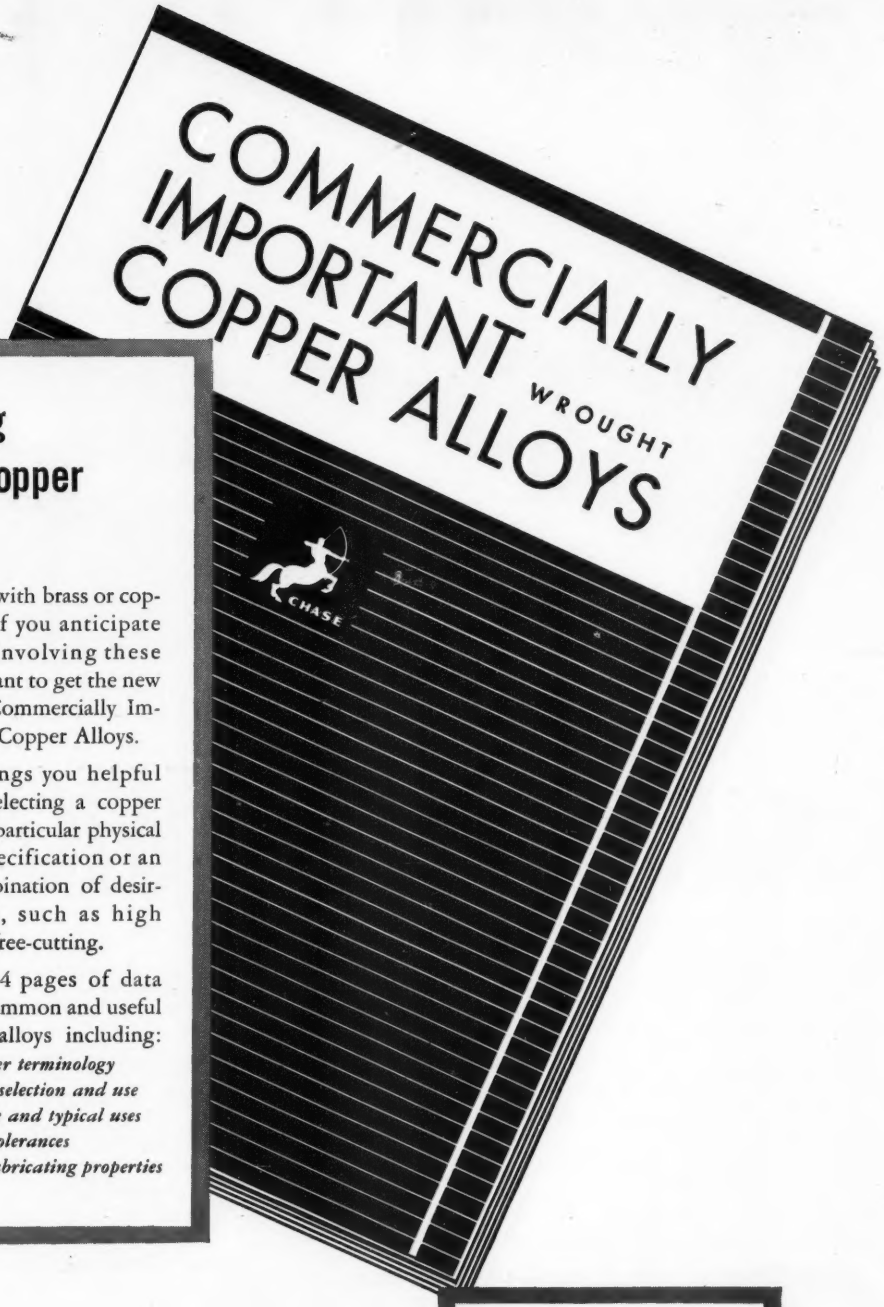

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CHASE 75th ANNIVERSARY 1876 1951

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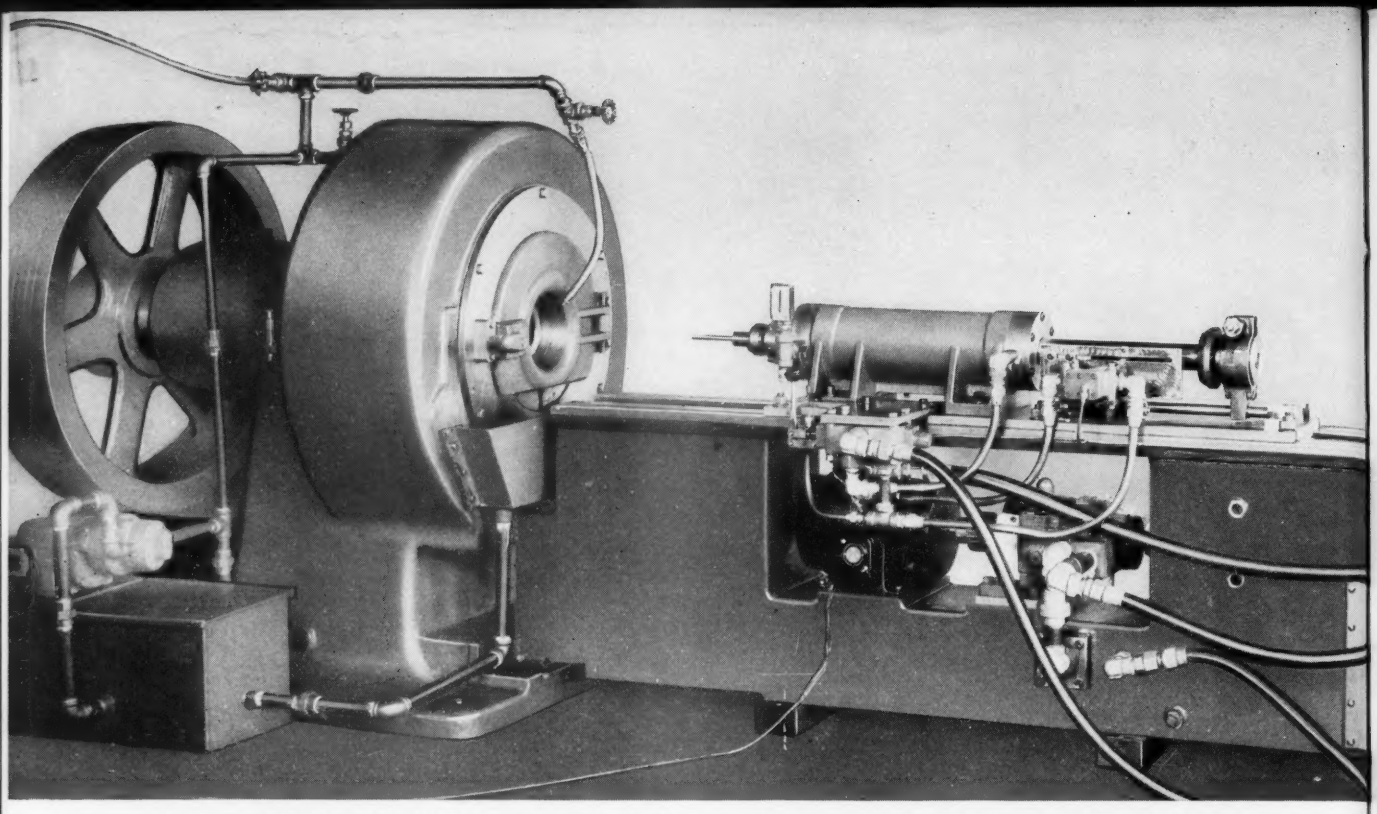

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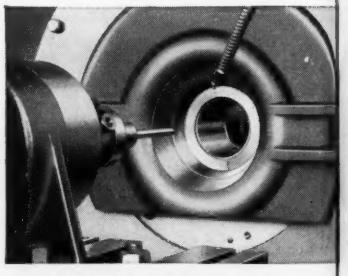

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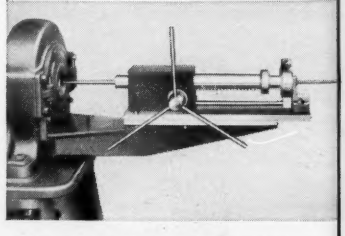

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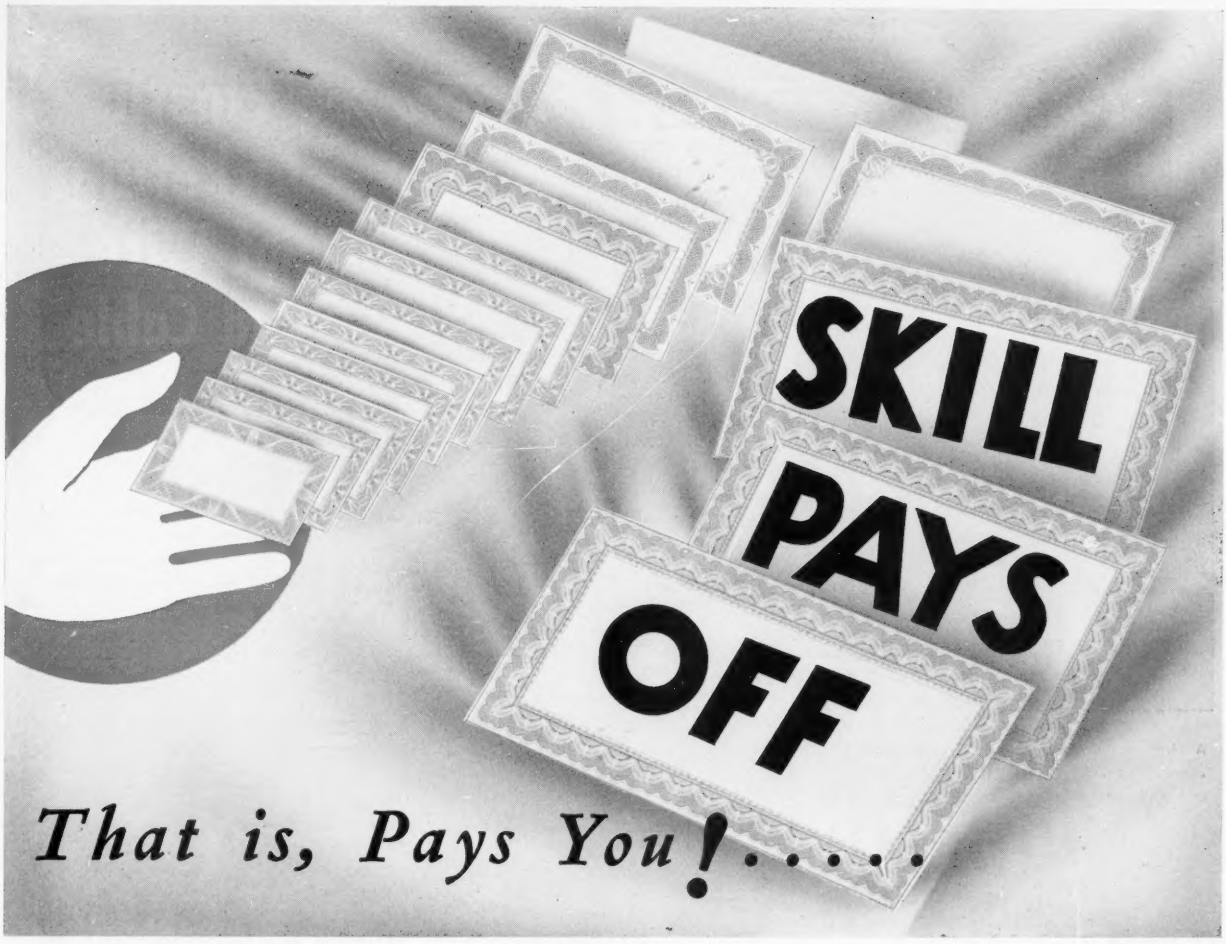

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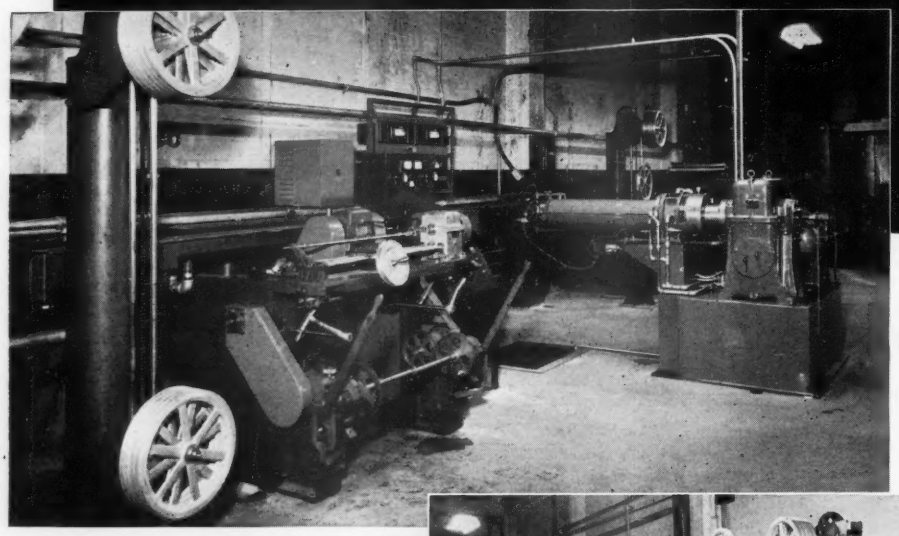
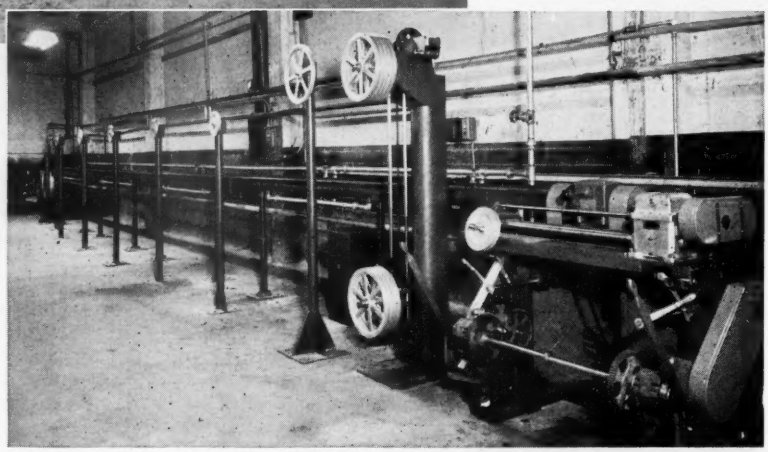
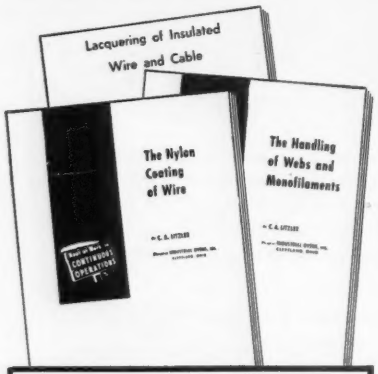


A view from the takeup end of a complete extrusion line with nylon head tuber. Driven letch stand and tension stand shown in the background.

A view of the same extrusion system showing capstan, cooling trough, tension control stand and continuous takeup machine.





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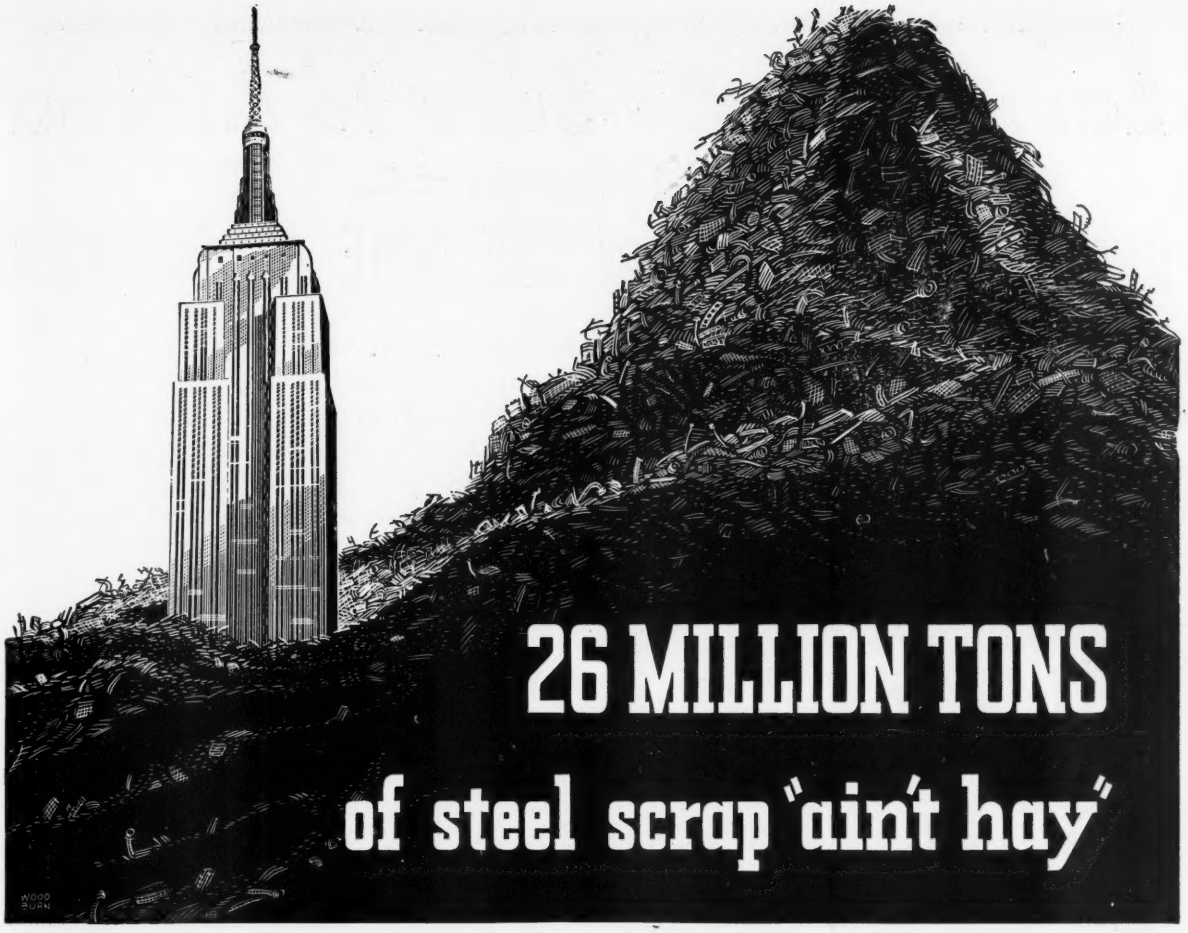

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The 1951 Program of the

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For you FERROUS men there will be papers on dry cleaning of rods and wire, new pickling developments, on how to make better cold heading wire, on bolt and nut manufacture, on galvanizing blankets and on patenting, cleaning and coating.

For you NON-FERROUS men, there will be papers on signal corps wire, on new copper alloys, on high nickel alloy wires, on magnet wire, on combustion of wire enameling fumes, on wire coatings, on preparation of PVC compounds and on finishes for electric wire and cable.

You'll want to attend the Annual Wire Association Luncheon, at which Sidney Rolle will deliver the Mordica Memorial Lecture on "The Fabrication of Copper Wire".

You'll want to attend that celebrated feature on Wednesday evening—the annual Stag Smoker-Dinner. It will be full of fun and fine entertainment.

And you'll not want to miss that Plant Inspection Trip on Thursday—an all-day tour of the Joliet Mills of the American Steel and Wire Company—one of the finest wire mills in the country.

The complete program is published in this issue.

MAKE YOUR PLANS NOW TO ATTEND. ALL WIRE MEN ARE CORDIALLY INVITED. IF YOU DO NOT RECEIVE A HOTEL RESERVATION CARD SHORTLY, PLEASE WRITE FOR ONE.

The time: October 22-25. The place: LaSalle Hotel, Chicago, Ill.

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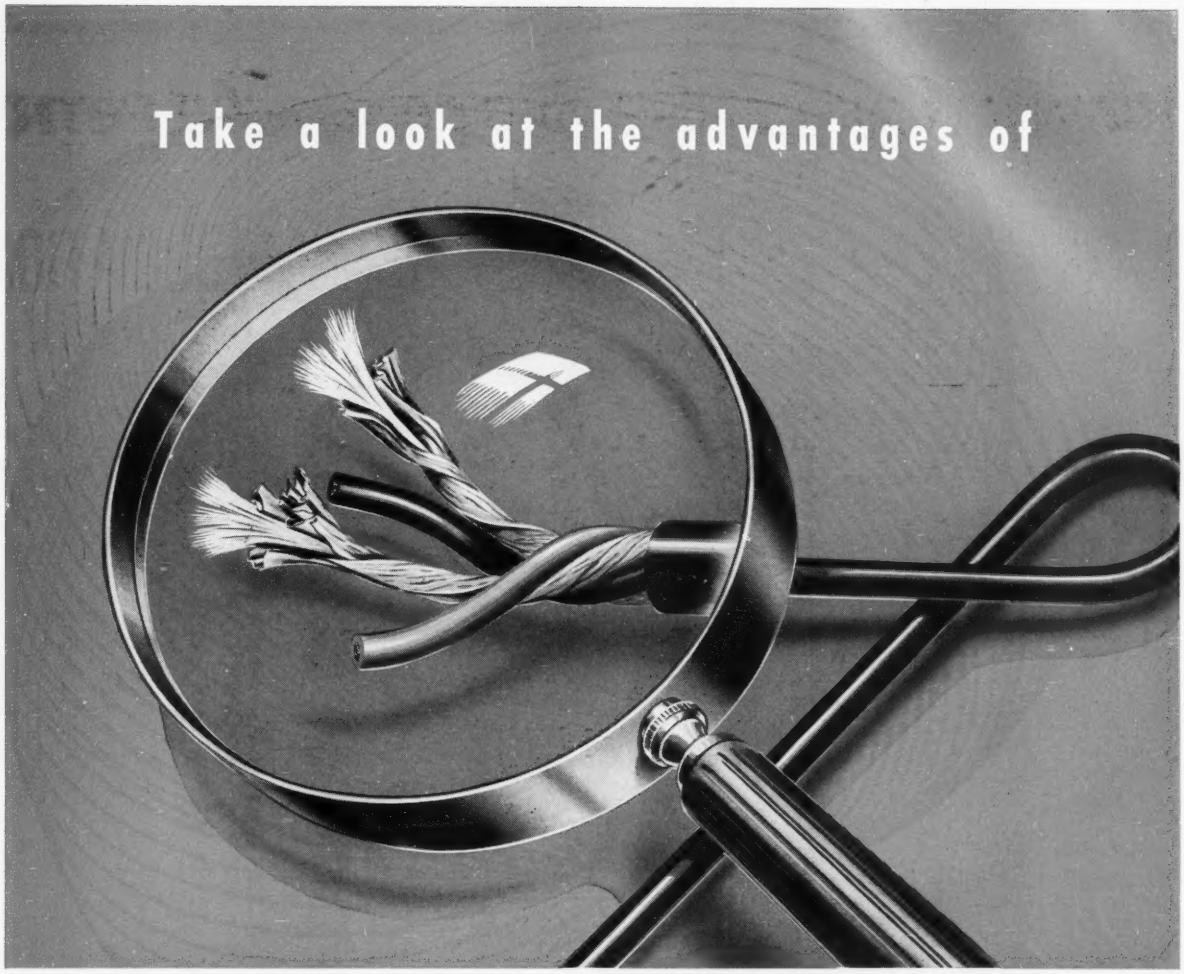

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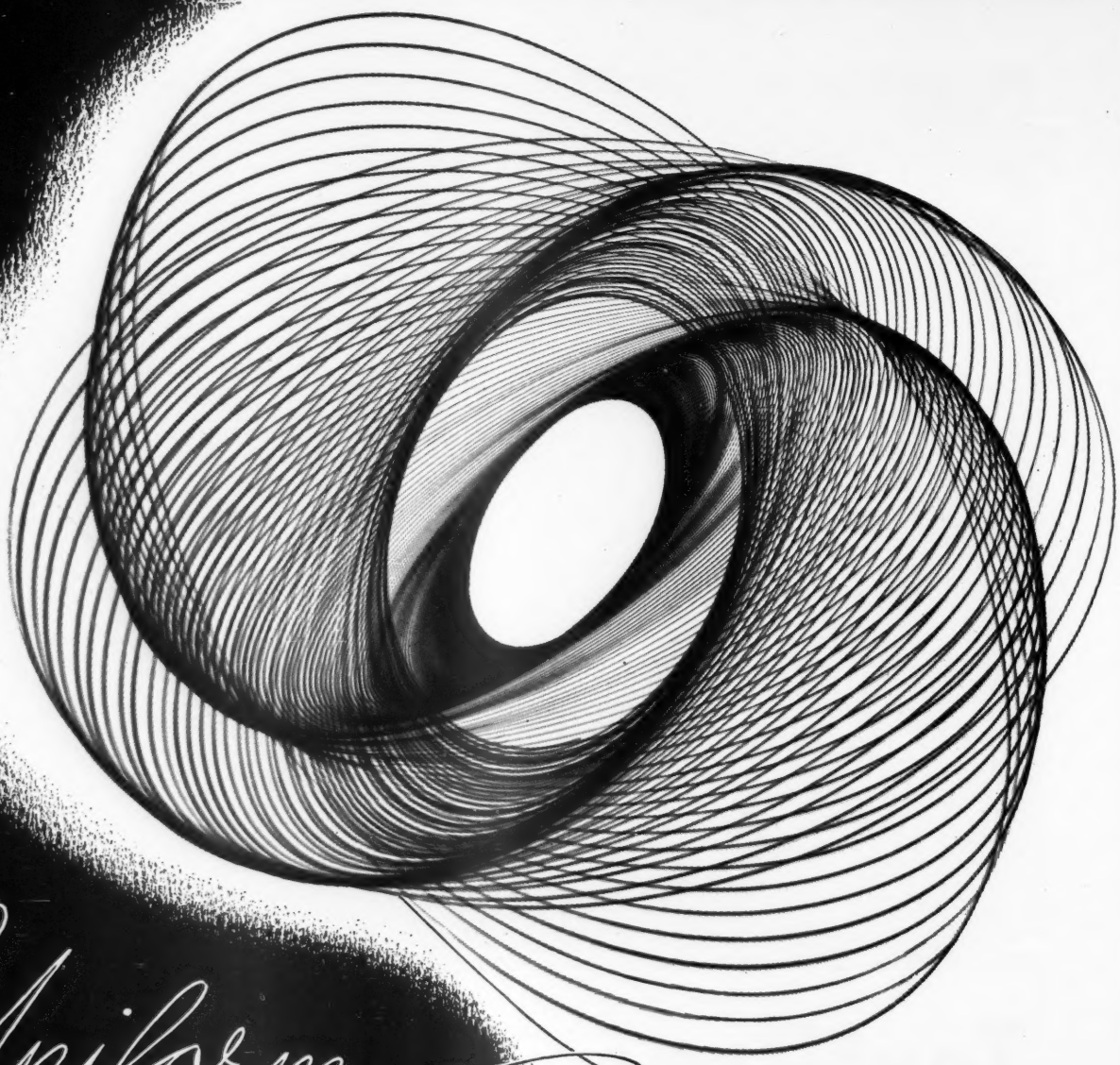

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The Wire Outlook

Through the Summer business has been slow; something more than the seasonal let-down. With the normal Autumn pickup, activities should begin to get into high gear and make some new records in 1952.

Over-large inventories have been principally responsible for slow business, together with a tendency on the part of the public to save, rather than spend. A general revival of trade is already taking place that will gather momentum as we get into the Fall. Installment buying is once more on the increase.

A reasonable stability in prices is hoped for for the balance of the year. While wages will be adjusted upwards in most quarters, the full amount will not be reflected in prices. Very few rollbacks are anticipated under the new price control law. Next year, with things booming, labor will start agitation for another futile round of increases.

The rationing of steel, copper and aluminum, under the new Controlled Materials Plan, is more tangled and confused than was expected. Some say it won't work until all users, late in the year, are subject to its provisions. Ontly time can tell. The change-over from the OD to the CMP system is working less smoothly than the CMP's worst critics predicted.

Copper imports for the first five months of 1951 have averaged 9600 tons per month less than in 1950. Total imports for the period have actually been 211,400 tons; since 60,900 tons were exported, our net gain was only 150,500 tons. Domestic production runs about 534,500 tons and consumption around 725,200, leaving a deficit of 190,900 to be made up by importing. This would be easy under peace time conditions, but stockpiling takes just enough copper to throw our industrial requirements into the red. While domestic production is climbing, the rate is slow by comparison with needs. It should be noted also that our Chilean copper sources of supply have been closed to us during the period of two long strikes this year. A new pact and higher prices should enable larger supplies to come through in the second half.

Larger set-asides on steel rods and wire have put about 90% of the wire under controls. Allocations, however, are said to be liberal, especially for customers using 100 tons or less in a quarter.

Curtailed automobile production has caused some softness in the demand for upholstery and automotive valve springs, although calls for most kinds of wire appears to be on the increase.

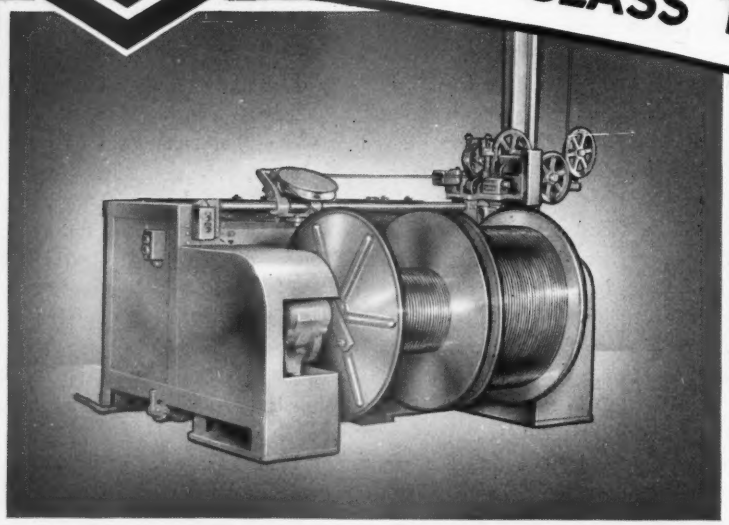
Many fastener plants have had to cut operations for lack of rods. Most concerns in this field have worked off their inventories and are buying on a hand-to-mouth basis.

We recently ran across a resolution passed at a Town Meeting at Eastham, Mass., on February 27, 1773, that could be applied to many current Washington officeholders. The occasions for it were the oppressive taxes and the unendurable burdens imposed by England on the colonies in violation of the guarantees provided by the charters to the colonies and the constitution of Great Britain. A meeting was about to be called to impose further burdens. The resolution reads: "That every true friend of his country who shall have offer of a seat . . . . . upon such a detestable plan as we hear is established, will have his memory blessed if he rejects it with abhorence; and that all who accept as above . . . . . will be objects of contempt".

The average citizen might well apply this language to a lot of Washington politicians. To these gentlemen, we recommended that "if the shoe fits, put it on".

—from the Editor's Desk

THE NEW AUTOMATIC DUAL TAKE-UP CLASS T



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See page 785 for a complete listing of JLE products for the insulated and bare wire industry

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WIRE AND WIRE PRODUCTS

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 26 SEPTEMBER, 1951 No. 9

SOME PRINCIPLES OF CONTINUOUS WIRE DRAWING

by Clement Blazey, Chief Metallurgist
and Vivian W. Benjamin, Technical Officer
Metal Manufactures, Ltd.
Port Kembla, Australia

Getting back to first principles in such an old art—today more a science—as wire drawing, is most important. In the study presented by the authors, our readers will find valuable information set forth that should assist both wire drawers and machine builders in their efforts to provide drawing conditions that are conducive to more efficient operation of equipment. All this is to the end that better wire may be produced through an understanding of the factors and forces involved in the drawing of wire. The discussion is concerned with copper wire.

In the practical field of wire drawing, a man has to learn the hard way — by experience, but there is no good reason why he should not hasten the task of learning by the use of pencil and paper and a little quiet thought. The present authors have profited by a study of wire drawing along such lines and, while they do not suppose for a moment that what they have to say in the following pages has not long been known to machine designers and experts in drawing methods, they fancy that it may be of help to others who, like themselves, have been unsuccessful in finding descriptions in technical literature of underlying principles in the multi-die continuous wire drawing process and who have had to seek for those principles at works' level. Their study has been concerned with simple graphic and arithmetical methods checked by practical experience in a mill producing non-ferrous metal (mainly H.C. copper) wire in tandem and cone types of machines of American, British, and German design.

* * *

In the following description, little or no reference is made to the engineering problems of machine detail and design, attention being confined to the wire side of the drawing process. An informative article on some of these other aspects, such as drawing forces, capstan speeds, heat generated in drawing, etc., treated mathematically, has been published in recent years by S. Geleji.*

* * *

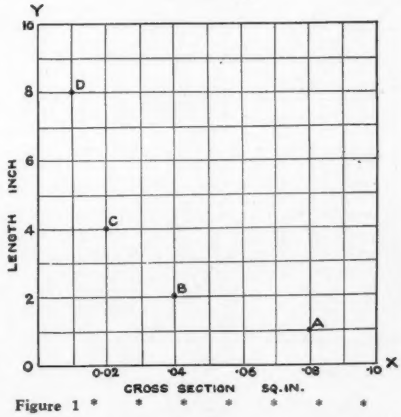

Figure 1

In continuous wire drawing, use is made of a machine equipped with a set of capstans (6. 8, 10, 12, etc.) driven in such a manner that the surface speed of successive units increases from one end of the machine to the other. In addition, there is a take-off block or spooler to collect the drawn wire, a set of dies of increasingly smaller diameter, and a plentiful supply of lubricant.

* * *

The following discussion centres around the dies, the capstans, and the block, which, from the metal-working aspect, constitute the basis of continuous wire drawing.

* * *

Basis of a Graph

In order to arrive at a graphic representation of wire drawing, take a sheet of squared paper and draw axes OX and OY as shown in Fig. 1 with cross sectional area marked off along OX and length marked off along OY. Any point on this paper can be taken as representing a volume (cross sectional area x length). Point A, for example, can be taken as representing a piece of metal 1 in. long x 0.08 sq. in. cross section = 0.08 cu. in. volume. Another point B can be taken as representing a piece of metal 2 in. long x 0.04 sq. in. cross section =

*"Wire drawing with continuous drawing machines," Prof. S. Geleji, The Wire Industry (London), 1949, xvi, 181, 53-56.

0.08 cu. in. volume, and so on with points C and D until a curve is drawn representing constant volume of 0.08 cu. in. A number of such curves representing different volumes is shown in Fig. 2.

★ ★ ★

Using a well known dodge, we can plot length and cross sectional area logarithmically instead of in simple units as in Figs. 1 and 2 so as to straighten out the curves and produce a series of parallel straight lines representing volumes, as in Fig. 3. This last figure is essentially the same as Fig. 2 but with certain advantages such as more open spacing.

★ ★ ★

Application of Graph to Wire-Drawing

Let us consider this graph in terms of rolled copper rod that has to be drawn to wire in a standard type of continuous machine.

★ ★ ★

It is a fundamental principle of drawing, as of any continuous method of working metal, that the same quantity (i.e. weight or volume) of metal is passing any selected point of the machine as any other point along the machine in unit time. In other words, as great a volume of metal in the form of 0.0641 in. wire is passing per minute from the last die to the drawing block as is entering the first die in the form of rolled rod when the machine is set to draw 14 B. & S. gauge wire. So much is obvious, and what is also obvious on second thought is that, as volume=length x cross section, and as length passing in unit time= speed, therefore at any point along the machine, from the swift or take-up to the finishing block, cross section x speed is a constant, which we call k. To take an example: If 0.0641 in. wire is passing to the block at 3105 ft/min, the volume of finished wire being drawn per minute is 0.0641 x 0.0641 x 0.7854 x 3105 x 12=120.24 cu. in. Hence, if the ingoing rod is 1 B & S gauge, it must be entering the first die, irrespective of the exact size of that die, at 120.24÷(0.2893 x 0.2893 x 0.7854) ÷12=152.4 ft/min.

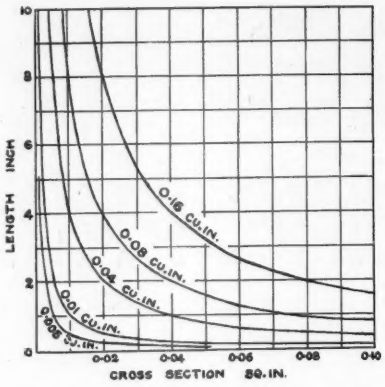

Figure 2

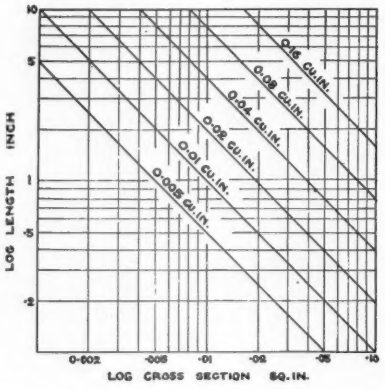

Figure 3

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With this guiding principle at command, we can turn to the graph and plot speed against cross section logarithmically and, for convenience, we can insert the standard wire gauges at their appropriate positions along the horizontal axis, as in Fig. 4. Before going further, however, we need to know certain characteristics of the machine we happen to be considering, and, for the moment, we can be content with a knowledge of the capstan speeds in terms of peripheral or surface ft/min. On the assumption that we are considering a well-known make of 13-die machine, which we can designate as make 'S', having 12 capstans arranged in stepped cone fashion in 4 groups of 3, and designed to operate with slip, the capstan speeds we require are to be found in the maker's catalog as follows in Table 1:

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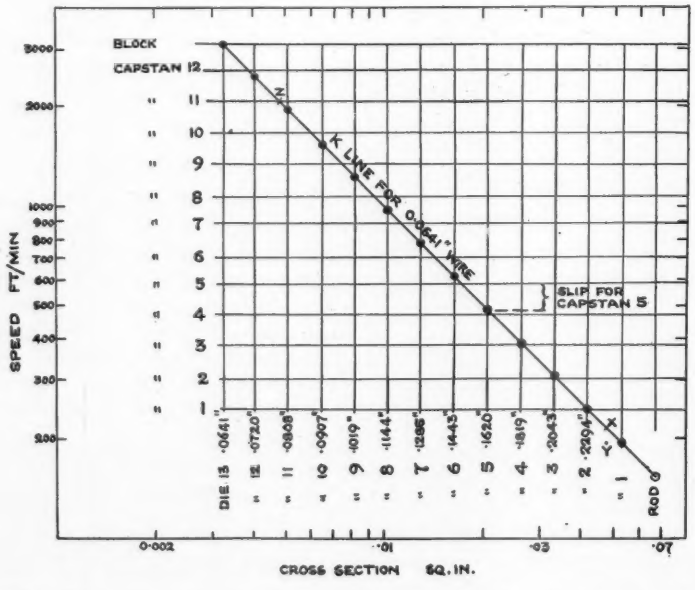
Table 1. Capstan Speeds

Capstan	Speed
First	245.4 ft/min
Second	301.5 "
Third	378 "
Fourth	465 "
Fifth	579 "
Sixth	711 "
Seventh	885 "
Eighth	1087.5 "
Ninth	1362 "
Tenth	1677 "
Eleventh	2085 "
Twelfth	2565 "

These capstan speeds can be plotted at their respective horizontal positions 1 to 12 in Fig. 4. Further, by calculations similar to those already given, the constant volume or k line can be plotted for the wire starting at 1 gauge and finishing at 14 gauge. If we now mark the posi-


BLOCK
CAPSTAN 12
SPEED FT/MIN
K LINE FOR 0·0641" WIRE
SLIP FOR CAPSTAN 5
DIE 13 ·0641" ·0720" ·0808" ·0907" ·1019" ·1144" ·1285" ·1443" ·1620" ·1819" ·2043" ·2294"
ROD 0
CROSS SECTION SQ.IN.
Figure 4

tions of the dies as dots, in steps of gauges, we have the essentials for a graphic representation of wire drawing.

★ ★ ★

Two points are immediately apparent, namely:

★ ★ ★

1. **All** die sizes or drafts must lie on the k line.

★ ★ ★

2. **Each** draft must lie below its corresponding capstan speed horizontal.

★ ★ ★

To prove the first point, let us assume that, instead of using a 0.2576 in. die for the first draft, we use a smaller die. The position of this die on the graph would not lie horizontally to the left of the dot representing die 1 in Fig. 4, i.e. at Y, but at X where the vertical line for the smaller die cuts the k line, as that is the only position satisfying the cross sectional area x speed or k relationship. In other words, if the die size is changed, the speed of the emerging wire is automatically changed (an important principle to which further reference will be made later).

★ ★ ★

To prove the second point, let us assume that the position of die 11 is at Z in Fig. 4. This shift in position would mean that wire speed would then be equal to capstan speed, which would violate the principle of slip. Any position above Z would indicate that wire speed was greater than capstan speed, which would be absurd in a slim type of machine.

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Table 2 - Capstan Slips for Type 'S' Machine

	When finishing speed is 2070 ft/min	When finishing speed is 3105 ft/min
First capstan	34.6 ft/min	51.9 ft/min
Second "	38.5 "	57.75 "
Third "	47 "	70.5 "
Fourth "	52 "	78 "
Fifth "	61 "	92 "
Sixth "	65 "	97.5 "
Seventh "	74 "	111 "
Eighth "	75 "	112.5 "
Ninth "	89 "	133.5 "
Tenth "	86 "	129 "
Eleventh "	90 "	135 "
Twelfth "	70 "	105 "

A third point now emerges, namely:

3. **The** vertical distances between the horizontals representing capstan speeds and the dots marking the die positions are the exact slips for the capstans (see, for example, the slip marked for capstan 5).

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For the machine under consideration, the slips as given in the maker's catalog are as follows (Table 2).

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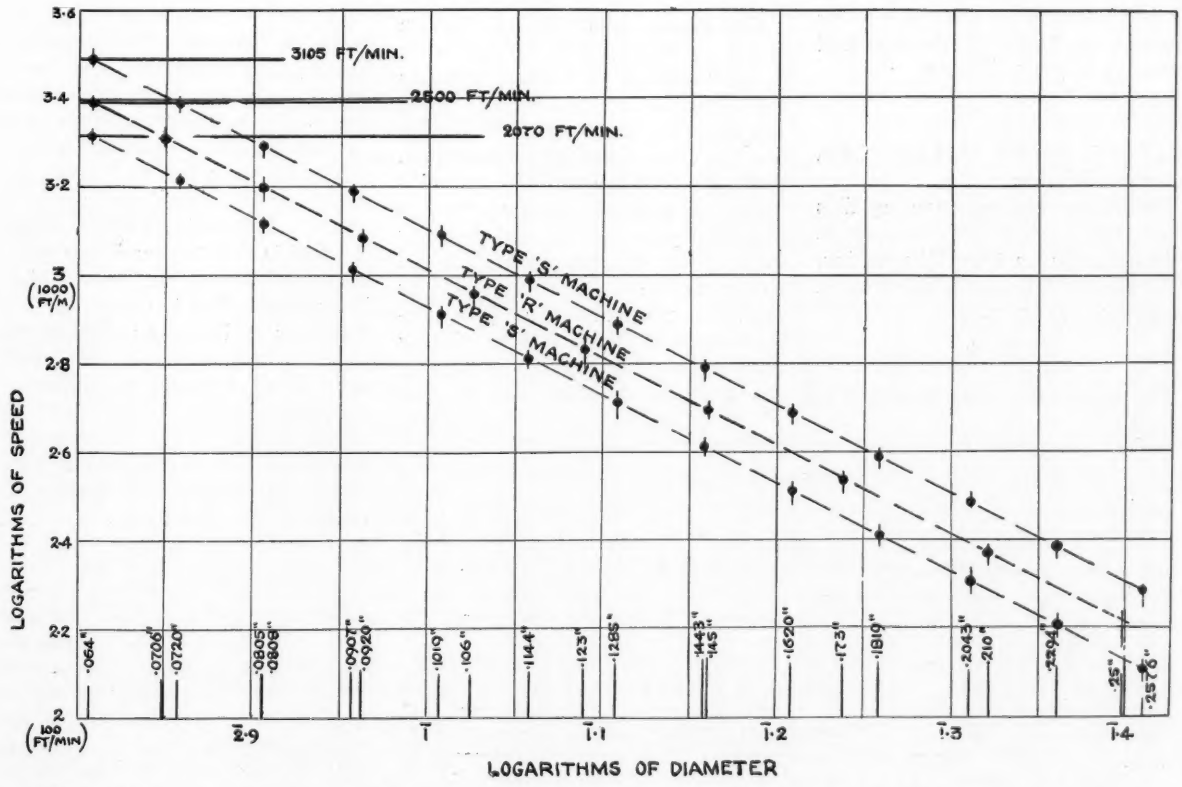

Figure 5

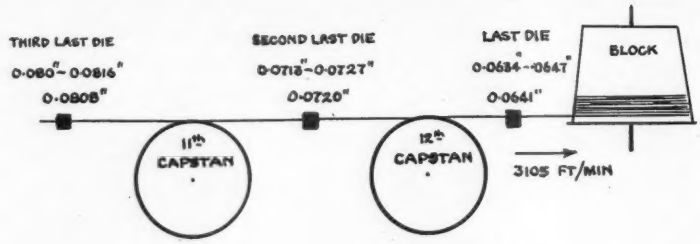

Figure 6

For a working model of a graph, some details can be omitted from Fig. 4 and the axes OX and OY scaled according to actual logarithms of die diameters and speeds, as in Fig. 5. The advantage of this method of plotting is that, as the axes are divided into equal steps, the drawing of co-ordinates is more easily done than when the axes are divided logarithmically as in Fig. 4. For instance, on comparing Figs. 4 and 5 we can see that the plotting of a speed of 885 ft/min on Fig. 4 is not such a quick matter as on Fig. 5 where we merely have to look up log 885 and then draw a line at 2.947 with a rule or on squared paper if that is being used. Similarly with die diameters along OX where, for example, the 0.0641 in. die is plotted at the log of .0641=$\overline{2}$.8069.

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In Fig. 5, three k lines have been drawn as follows:

1. **The upper** one representing dies for 0.0641 in. wire finishing at 3105 ft/min on type 'S' machine, the die sizes being those given in the maker's catalog.

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2. **The middle** one representing dies for 0.064 in. wire finishing at 2500 ft/min on type 'R' machine (a well-known British make), the die sizes again being those given by the maker.

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3. **The lower** one representing die sizes for 0.0641 in. wire finishing at 2070 ft/min in type 'S' machine, die sizes again being obtained from the maker.

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In this graph, no capstan speeds have been plotted, but on a working graph they would invariably be shown.

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Experience has shown that a graph of this kind is of assistance in the selection of a set of dies for any required finished size of wire. All that has to be done is to plot the required finished size against block speed at the top left hand corner of the graph and draw a 'k' line from that point to the point marking starting size of wire or rod at the bottom right hand corner. Then, as each intermediate die (the unknown) must lie on this line below its corresponding capstan speed line, the true die position can be obtained by selection. Many die sizes, of course, fit the k equation, but the approximate position of the most suitable size can be obtained quickly and can then be pin-pointed by a consideration of capstan slip.

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Table 3

	Second last die inch	Wire Speed ex second last die ft./min.	Speed of last capstan ft./min.	Slip ft./min.	Last die inch	Finishing speed ft./min.
1	0.0713	2455	2565	110	0.0634	3105
2	0.0713	2557	2565	8	0.0647	3105
3	0.0720	2461	2565	104	0.0641	3105
4	0.0727	2361	2565	204	0.0634	3105
5	0.0727	2460	2565	105	0.0647	3105

The Problem of Slip

So far, we have taken slip for granted and have accepted without question the various capstan speeds as given in the maker's catalog. The time has now arrived to enquire why slip is necessary at all and why it is as much, or as little, as is to be found in the different makes of machines using the maker's recommended drafts. Slip is the difference between the peripheral speed of the capstan and the speed of the wire around that capstan; it can be expressed either as ft/min or as a percentage of the capstan speed. One would think that, if the speed of a wire emerging from a die exactly matched the following capstan speed, and the dies and capstan bands did not change in size during drawing, there should be no need for slip, but in practice dies do not remain unchanged and capstan bands are subject to wear. Further, in a tandem or cone machine, in which drawing is done with wet lubrication, it might be difficult to prevent slip altogether even in conditions where dies and capstan bands did not wear because of the lubricating effect of the thin film of lubricant on wire and band; but, whatever the position might or might not be in ideal circumstances, the fact is that the machines are designed to draw with the use of slip. Let us see what the changes in die diameter and capstan diameter necessitate by considering the case of wire being finished at nominal 14 gauge at 3105 ft/min in type 'S' machine. In Fig. 6 the last three dies at nominal B & S gauges are sketched in conjunction with the last two capstans and the block.

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As standard specifications usually allow a variation of ±1% on diameter of finished wire, we can start the last die at, say, 0.0634 in. and replace it when it has worn to 0.0647 in. Let us assume that the last die undergoes this range of wear and that the other dies and the capstans remain unchanged. When the ma-

chine starts to draw wire at 0.0634 in., the volume of metal passing to the block per minute is 0.0634 x 0.0634 x 0.7854 x 3105 x 12 = 117.63 cu. in., and when, with the die worn, it is drawing wire at 0.0647 in., the volume of metal passing to the block per minute is, by a similar calculation, 122.50 cu. in. This change in volume applies to the wire passing through all parts of the machine; it is a change in the k value.

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With this point established, let us assume that the second last die is started 1% under nominal size at, say, 0.0713 in. On the principle that cross section x speed is a constant for a particular block speed and finishing die size, it is clear that the speed of the wire emerging from the second last die at the commencement of drawing must be 117.63÷(0.0713 x 0.0713 x 0.7854) ÷ 12 = 2455 ft/min. When, however, the last die has worn to 0.0647 in., and the k value has become 122.50, the speed of the wire emerging from the second last die must have increased to 122.50÷(0.0713 x 0.0713 x 0.7854)÷12=2557 ft/min. This change in speed is made automatically. It means that the difference between capstan speed and wire speed, whatever it might be initially according to the design of the machine, is decreased by 2557—2455 =102 ft/min by the time the finishing die has worn to its allowable limit. Hence, if the last capstan did not have an initial advantage in speed of 102 ft/min over the wire speed, the required supply of metal to the last die could not be maintained and the wire would tighten around the capstan and break.

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Other possibilities with size and speed are given in Table 3. The only details in this table that have been taken from the maker's catalog are the capstan speed and the finishing speed.

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As already indicated, these changes in capstan speed-wire speed =slip are made automatically in the machine as a 'going concern'. It can be seen that, provided a close watch is kept on permissible allowances for die wear, the last capstan need not have an intial advantage in speed over the wire passing around it of much more than 100 ft/min. In the maker's catalog, the slip on the last capstan is given as 105 ft/min when block speed is 3105 ft/min and capstan speed is 2565 ft/min. The machine under consideration is referred to as a minimum slip type, apparently with justification.

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The significance of the initial speed advantage on the capstan is, of course, that the wire speed cannot automatically catch up to or exceed the capstan speed and lead to a wire break through tension. This initial advantage in speed we can call 'designed' or 'primary' slip. The additional slip created by the

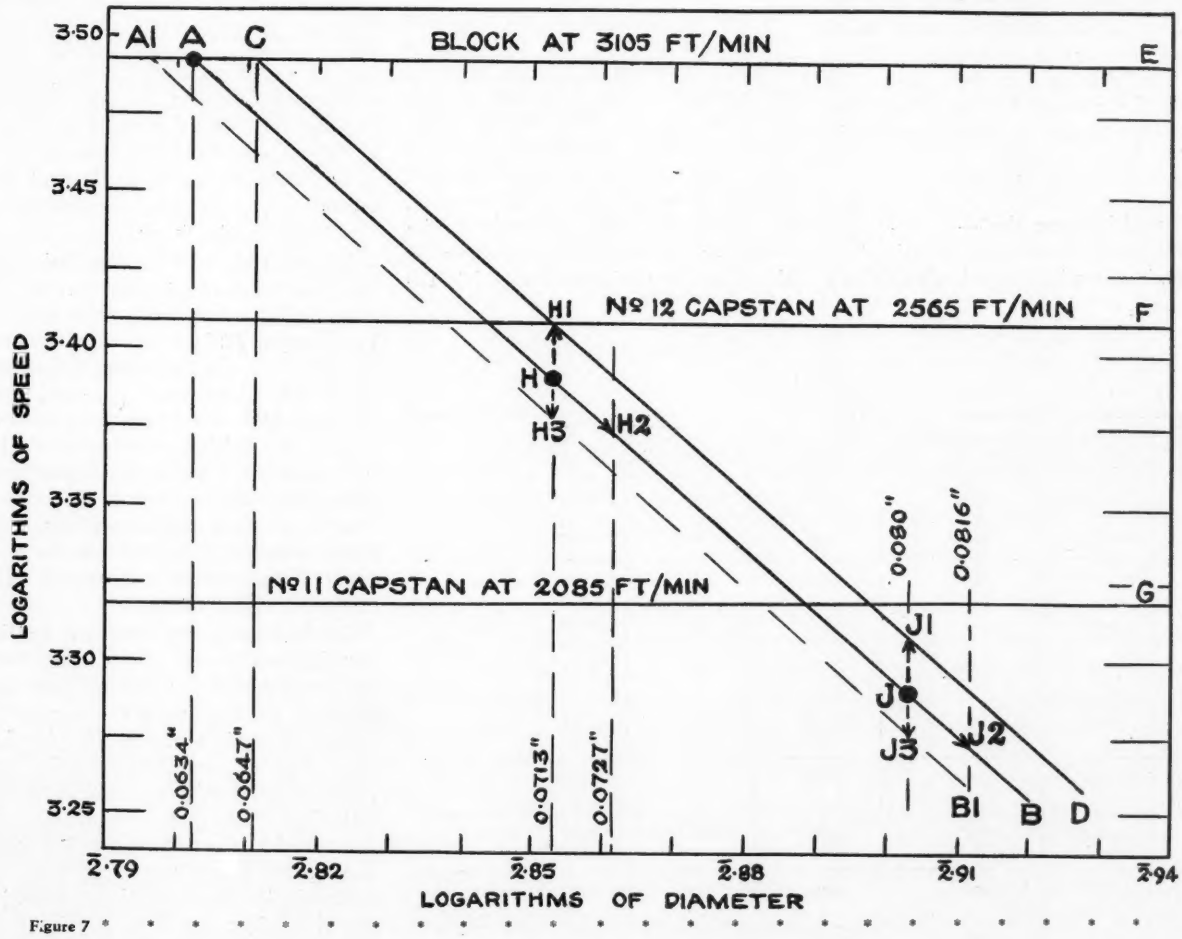

Figure 7

slowing down of wire speed (horizontal column 4, Table 3), and due to greater wear of the second last than of the last die, we can call 'created' or 'secondary' slip. In the conditions embraced by Table 3, it amounts at most to 204—104=100 ft/min (difference between horizontal columns 4 and 3).

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Turning now to the eleventh or second last capstan (Fig. 6), let us assume that the last two dies remain at 0.0634 in. and 0.0713 in. respectively and that the third last die wears from —1% to +1% of nominal size, i. e., from 0.080 in. to 0.0816 in. From calculations similar to those given above, it can be shown that the speed of the wire emerging from the third last die changes from 1950 ft/min at the start to 1874 ft/min at the finish of die wear, compared with a capstan speed (from maker's catalog) of 2085 ft/min. In practice, however, wear occurs in all three dies, either separately or concurrently, and the range of possibilities with wire speed and slip is as shown in Table 4. The details for wire emerging from the second last and last dies are the same as those given in Table 3.

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It will be seen that—

1. Of the 130 odd feet of slip (135 ft. is given in the maker's catalog) provided by machine design, about 80 ft can be cancelled out through full permissible wear of the last die together with no wear at all of the third last die. Excluding for the time being any wear of capstan bands, which will be considered below, this is the extreme case to provide for. It would appear that, if conditions of machine design permitted, a slip on the eleventh capstan of less than 135 ft/min could be tolerated.
2. **It is** only because of wear of the finishing die that slip is required on the capstans, and then only when the finishing die wears proportionately more than intermediate dies.
3. **If all** dies wear proportionately, there is no need for slip on account of the dies.

Full implications may be obtained from the Table.

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Wear of Capstan Bands

Wear of capstan bands reduces slip and therefore has to be provided for in original design. To take an example. The diameter of the eleventh capstan (Fig. 6) is given in the catalog as 19 in. and the r.p.m. for a finishing speed of 3105 ft/min as 419.25. Peripheral speed is therefore 2085 ft/min. If the diameter is reduced by wear to 18.75 in. the peripheral speed is reduced to 2059 ft/min, and if it is reduced to 18.5 in. the peripheral speed is reduced to 2031 ft/min.

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On reverting to Table 4, it will be seen that full wear of the last die with no wear of the third last die reduces slip to 54 ft/min. This remaining slip could be entirely cancelled out by a concurrent reduction through wear of 0.5 in. in the diameter of the eleventh capstan. Hence, slip is required on all capstans not only because of wear of the finishing die but also because of wear of capstan bands.

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In the 'S' type of machine under consideration, replaceable bands are provided on the capstans to overcome loss of capstan slip through wear.

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Closing-in of Dies

So far, we have considered the effects of the wire diameter becoming larger through die wear, but it sometimes happens that wire diameter is smaller than is intended either through 'ringing', or part closing of the hole through collection of copper dust, or through copper plating, or other reason. The effect is that a greater reduction of area is imparted to the wire than is desired.

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Let us assume that the finishing die is the one to be affected. As the speed of the emerging wire cannot be changed (it is determined by the block), our fundamental principle of cross sectional area × speed = a constant tells us that less metal must pass from finishing die to block in unit time than formerly, which implies that the speed of the wire emerging from all the other dies must automatically slow down and create additional or secondary slip.

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Let us next assume that the finishing die remains unaffected and that the second last (or any earlier) die starts to produce wire smaller in diameter than is desired. The fundamental principle tells us again that as the volume of metal passing from finishing die to block is unchanged, the speed of the wire emerging from the affected die must increase to maintain the cross sectional area × speed relationship. This implies that

TABLE 4

	Third last die inch	Speed of wire ex third last die ft./min.	11th Capstan speed ft./min.	Slip on 11th Capstan ft./min.	Second last die inch	Last die inch
1	0.0800	1950	2085	135	0.0713	0.0634
2	0.0800	2031	2085	54	0.0713	0.0647
3	0.0800	1950	2085	135	0.0727	0.0634
4	0.0800	2031	2085	54	0.0727	0.0647
5	0.0808	1954	2085	131	0.0720	0.0641
6	0.0816	1874	2085	211	0.0713	0.0634
7	0.0816	1952	2085	133	0.0713	0.0647
8	0.0816	1874	2085	211	0.0727	0.0634
9	0.0816	1952	2085	133	0.0727	0.0647

the speed of the wire emerging from the affected die will tend to overtake the capstan speed.

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Hence, slip is required on all capstans to provide for the possibility that any die except the last may start to produce wire of smaller diameter than is desired. It is not required on any capstan to provide for the possibility that the last die may start to produce wire of smaller diameter than is desired. This state of affairs is the very reverse of that obtaining for die wear.

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Inlet End of Machine

There remain for consideration the changes that occur at the inlet end of the machine. Assuming that the ingoing rod is nominal 1 gauge and that we start the first die 1% under nominal 2 gauge at 0.2550 in, the speed of the wire emerging from the first die, provided that the finishing die is also started at 1% under nominal 14 gauge, is $117.63 \div (0.2550 \times 0.2550 \times 0.7854) \div 12 = 191.9$ ft/min. The range of possibilities on the basis of the first die and finishing die wearing from —1% to +1% nominal size are given in Table 5.

★ ★ ★

Table 5

Table 5 shows that, provided the dies are maintained within the ±1% limits on nominal diameter, the wire speed at its highest value will still be 45.5 ft/min slower than the capstan speed. The slip given in the maker's catalog is 51.9 ft compared with the 53.1 given in Table 5 for dies of nominal size. Any further wear of the first die beyond 0.2602 in. merely slows down the speed of the emerging wire and thereby creates additional slip; that is to say, there is no danger in allowing the first or any other die except the last to wear beyond the ±1% nominal size. The corrective in this circumstance is the reduction in area imposed on the wire emerging from the die following the overworn die. If this reduction becomes too great, a tensile break occurs, but, as is often the case, the place to look for the source of the trouble is not the die where the break occurs but the die behind or nearer to the inlet end of the machine.

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In order to cancel out the primary slip of 50 odd feet/min, the band on the first capstan would have to wear sufficiently to lose about 50 ft/min peripheral speed. In the machine under consideration, so much wear is out of the question. Hence, the wire speed cannot catch up with the capstan speed at the inlet end and cause a tensile break as it may almost do in certain conditions at the finishing end.

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A Final Graph

All these points concerning slip just described in tabular form can be represented on a graph similar to Fig. 5, but because of the relatively small changes in die size and wire speed involved, the graph must be enlarged to separate the lines and die positions clearly. In Fig. 7, therefore, a section only of the graph has been used to include the details shown in Fig. 6, namely, the block, the last two capstans, and the last three dies.

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The sloping line AB in this final graph is the k line for the commencement of drawing and the parallel sloping line CD is the k line for dies worn from —1% to +1% of nominal size. This gives a k band, as it were, covering all possible variations in die sizes and wire speeds. The horizontal line E is the block speed and lines F and G are the twelfth and eleventh capstan speeds respectively.

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If the third last and second last dies remain unchanged in size and the last die wears, point A will move towards C and set a new k line for the machine as a whole, which means that die points H and J must move vertically upwards until they meet the new k line at Hl and Jl respectively. So long as Hl and Jl remain below their respective capstan speeds, there will still be slip on the capstans, the amount of which can be read from the vertical scale of the graph. (Note, in this respect, how closely Hl goes to line F thereby illustrating the feature of minimum slip).

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If, on the other hand, finishing die A remains unchanged and dies H and J wear, die points H and J merely move down the k line to H2 and J2 respectively and the slips increase (which illustrates the creation of secondary slip). If all dies wear in the same proportion, the die points merely move across to the postulated limiting line CD.

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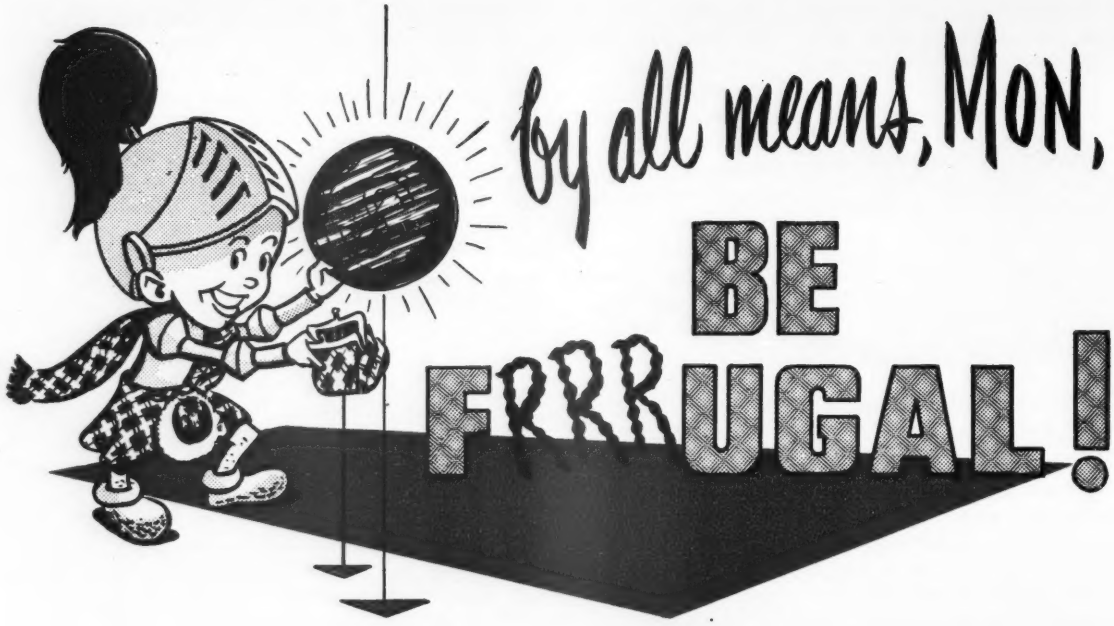
If, by mischance, the last die begins to draw wire smaller than is desired, die point A moves to the left to Al, let us say, to set a new k line at A1B1. If, while this is happening, the third last and second last dies do not change in size, then die points H and J must move vertically down to the new k line to H3 and J3 respectively; that is to say,

(*Please turn to page* 798)

Table 5

	First die inch	Speed of wire ex first die ft./min.	1st capstan speed ft./min.	Slip on first capstan ft./min.	Last die inch	Finishing speed ft./min.
1	0.2550	191.9	245.4	53.5	0.0634	3105
2	0.2550	199.9	245.4	45.5	0.0647	3105
3	0.2576	192.3	245.4	53.1	0.0641	3105
4	0.2602	184.4	245.4	61	0.0634	3105
5	0.2602	192	245.4	53.4	0.0647	3105



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VPI WRAP FOR WIRE PROTECTION

by Dr. D. W. Light
Director of Research
Angier Corporation, Framingham, Mass.

Savings and superior rust protection are the bases for the wide acceptance of VPI Wrap by industry. The source of lowered costs varies with the application, but usually takes the form of lower labor costs as a result of package simplification or elimination of slushing greases and their subsequent removal. The quality of the rust protection obtained and the versatility of VPI Wrap are upgrading the level of protective packaging.

★ ★ ★

VPI Wrap is a special neutral paper coated on one side with a synthetic organic chemical that has powerful corrosion inhibiting qualities. This chemical vaporizes slowly, and the invisible odorless vapors have the property of protecting ferrous metals from the rusting action of moisture and air. The vapors quickly permeate to all the metal surfaces that are susceptible to rusting. Such a property is particularly valuable when packaging wire and other products that have a high ratio of surface and surfaces that are not easily reached by the conventional contact inhibitors.

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These advantages of protecting with a vapor are self-evident, but the concept of such protection would ordinarily be discarded as impractical because of the difficulty in confining vapor within any common package. However, this is not a serious problem with VPI. The vapor concentration required within the package is low and rate of vaporization of the chemical from the wrap is sufficiently slow that protection for a year or longer can be obtained with very ordinary packages.

★ ★ ★

Taking full advantage of these properties, tight sealing is not necessary nor are punctureproof constructions required for most industrial packaging. The wrap need not conform to the protected article. Slushing oils or greases are not required, resulting in a cleanliness and eye appeal formerly obtained only with a dessicated pack. The article can be removed for inspection and replaced without destroying the protective package—although it should be noted that there is no protection after the removal of the treated paper.

The designation "VPI" is a trademark registered in the U. S. Patent Office and the chemical itself is a patented product, both belonging to the Shell Development Company. The company has licensed various concerns to manufacture and market VPI products. VPI, as the text of the article indicates, is a vapor rust preventive. Because of its unusual properties, it is revolutionizing some old notions regarding the packaging of materials that are subject to atmospheric oxidation.

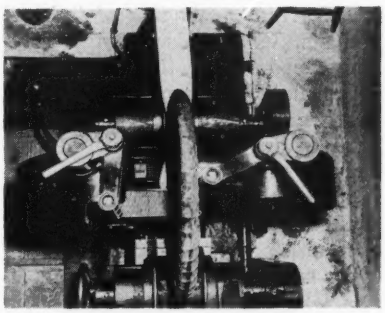

Figure 1

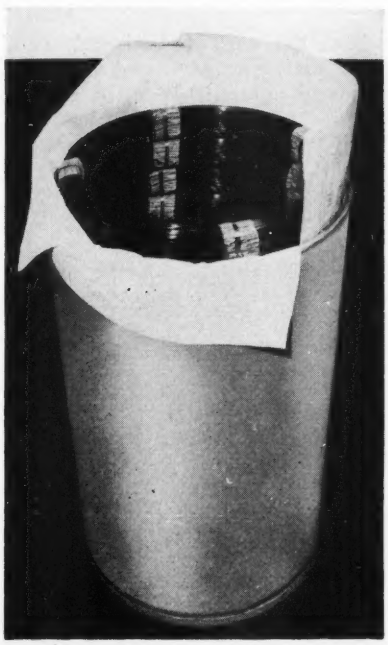

Figure 2

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The growing military usage of VPI is, of course, influenced by lower costs, but the services are placing particular emphasis upon the positive protection that can be obtained for periods of ten years or more and upon the "ready for use" condition of articles unpacked. (re. "Volatile Corrosion Inhibitors," by Major G. Foster, Ordnance, Sept.-Oct., 1950). A military specification, MIL-P-3420, for volatile corrosion inhibitors has been issued.

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VPI Wrap is commercially available in a variety of paper weights both flat and creped. Thirty and sixty-pound basis weight papers are the most common. Various VPI Barrier Wraps are also available for which the coated paper is backed with coatings or with other paper, foil, or plastic film. These barriers reduce transfer through the walls of the package and are used in place of outer wraps where exceptional exposure conditions are anticipated or when abnormally long protection is required. VPI paper can be laminated to boxboard for making lined boxes. With so many forms possible, it is readily apparent that VPI is adaptable to practically all types of packaging.

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Wire and wire products packaging offers many illustrations of VPI use. Coil wrapping of either round wire or strip stock is possible using

creped VPI Wrap on regular coil wrapping equipment, but it has been found more satisfactory to use a peripheral strip of creped VPI paper under the regular coil wrapping paper. When used directly for coil wrapping, the VPI surface at the overlap is not adjacent to the wire, and much of its effectiveness is lost. With the peripheral strip, all of the VPI surface is utilized, and it has been found that in spite of the fact that complete coverage of the wire is no obtained with such a strip, full protection is achieved. In some instances where double spiral wrapping is customary, a single wrapping with a peripheral strip will suffice, giving a double layer of paper on the outside edges and resulting in a substantial saving.

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Figure 1 illustrates a specific use of VPI in coil wrapping. In this case, a peripheral strip 5″ wide of VPI #310 creped is being fed in under the spiral wrapping of A-19 GRIZZLYBEAR, a creped, non-asphaltic laminated sheet made specifically for coil wrapping. Experience with this particular wrap has been most excellent even on steel that normally rusts very quickly.

★ ★ ★

Another coil package using VPI that has proven most successful is illustrated in Figure 2. Here, fibre drums are lined with creped VPI #310 with the VPI liner extending far enough above the drum that it can be folded across the top before the drum is closed. The coils are then stacked in the drums, if desired, with cushion separators—such separators preferably being VPI paper. Elimination of the spiral wrapping of each coil before placing in the drum showed an important saving. Another advantage of this pack is that the customer can open the drums upon their receipt, inspect the coils without removing wrappings, and if the coils are satisfactory, return them to the drum, lay on the cover, and retain complete protection of his storage stock. The primary disadvantage experienced to date has been that many concerns are not equipped to handle and store these fibre barrels.

★ ★ ★

Palletizing wire and strip coils is gaining favor and Figure 3 illustrates a pallet load of bare coils protected with VPI. VPI paper is placed face up on the pallet floor before loading, then a second sheet is used to shroud loosely the pile of coils after they are strapped down. The corrugated box cover completes the pack. The holes through the pallet floor for steel strapping are not sealed.

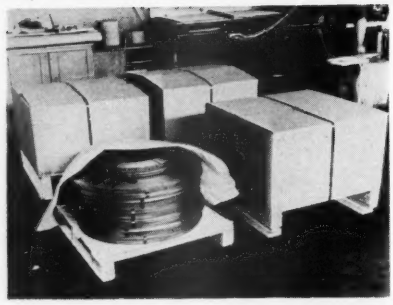

Figure 3 * * * * * * *

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Aside from packaging of finished products, VPI is also being extensively used for protection of parts in process. For example, stacks of wire and strip coils are being shrouded or hooded as illustrated in Figure 4 to obtain a degree of protection not previously practicable. Smaller parts in tote boxes are being protected with simple tote box covers of VPI Wrap. Such applications take full advantage of the vapor type protection.

★ ★ ★

Wire and wire products not in coil form are being packaged with VPI in many different ways, as are the steel products of other industries. This includes all types of boxes, cartons, tubes, bags, envelopes, etc. In most cases, a light-weight VPI paper is being used as an inner-wrap, liner, or insert or a fabricated bag or envelope. Where additional protection is needed, a VPI Barrier Wrap is used which is generally an asphalt laminated duplex either flat or creped. Packaging experience with VPI is now very extensive, and the best methods for using VPI are quite well established. The general rules followed are:

1. The innermost surface of the package should be the VPI coating. Where padding or supporting elements must be used inside the VPI vapor zone, care must be exercised in their selection and use that they do not themselves, cause corrosion or prevent the VPI from being effective at the point of contact with the article being packaged. The safest procedure is to have a VPI facing on such materials at the point of contact.
2. The package should be designed so that the VPI coating is relatively close to the surface to be protected. Although there are instances where satisfactory vapor protection has been obtained at distances of a foot or more, it is obviously good practice to avoid this handicap as much as possible. Where large cavities are involved, it is common practice to line the interior surface or to stuff a sheet or a wad of VPI paper into the cavity.
3. The package should be so designed that any air entering the package must pass over or through the VPI coating.
4. Overwraps of barrier materials or VPI Barrier Wraps should be used for outdoor or other exposure where sufficient water might otherwise get into the package to wash away the VPI or when extra long periods of protection are required.
5. VPI is not a cure-all and must be used properly. This requires an understanding of how it works and of its limitations.

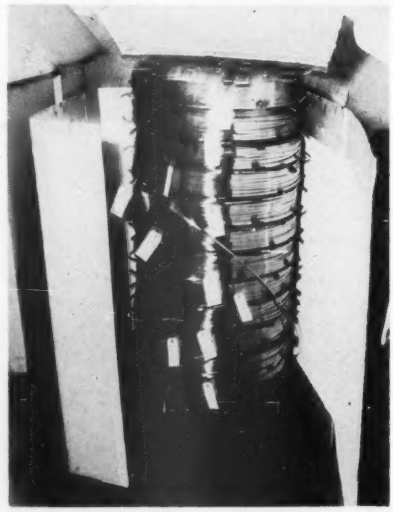

Figure 4 * * * * * * *

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To give more of the details, the active chemical is disyclohexlammonium nitrite. It is unique among the

many chemicals tested because of its outstanding stability while still having sufficient volatility even at low temperatures to offer positive corrosion control. Even where corrosion has already started, as from fingerprints, it has been found that further corrosion is stopped. There are other chemicals, including other amine nitrites, that vaporize, and whose vapors inhibit corrosion, but so far as we can determine, none equal VPI for use in packaging.

★ ★ ★

The stability of the chemical is, of course, the feature that makes vapor protection in packaging practicable. This determines the duration of protection and makes possible the long storage lives of the packages shown in Table I. Thermal stability of about fifteen years can be predicted for temperatures of 65-75° F and of about twenty-four months for a maintained temperature of 100° F. Thermal decomposition products are neither protective nor corrosive. It can be seen that failure due to thermal decomposition of VPI would be exceedingly rare and as a matter of fact, no instances have, as yet, come to our attention even though VPI has been used extensively for shipments through and into tropical zones.

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VPI is soluble in alcohols, particularly methyl alcohol, although the solubility in other organic solvents is quite low. The solubility in water is about 4%. This is sufficient so that the VPI coating can be leached out if excessive water passes through the package and, therefore, protection against such leaching action must be provided. Water containing only a trace of the chemical will not corrode steel, so that normal amounts of water that get into the package as a result of condensation or localized package failures will not generally cause rusting because sufficient VPI will be dissolved to make it non-corrosive. The chemical is essentially neutral; no reaction with oxygen has been detected. It is not hygroscopic. Its protective action is to passivate the steel surface by forming an invisible thin film that is maintained as long as VPI is present in the surrounding atmosphere.

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TABLE

Package Composition		Months Protection	
"VPI" Carrier	Outer Barrier	Shelf Storage Indoors (Wind ≤1 Mile/Hr.)	Open Shed Storage Outdoors (Wind 3-10 Miles/Hr.)
Kraft paper	None	10-14	
Waxed kraft	None	24-48	12-18
Kraft-asphalt-kraft	None	24-60	12-30
Cardboard	None	12-18	8-12
Waxed cardboard	None	24-60	15-24
30-lb. Kraft	Kraft paper	15-24	3-15
"	Cardboard	15-30	9-21
"	Waxed kraft	75 to ⩾120	24-54
"	Kraft-asphalt-kraft	75 to ⩾120	36-60
"	Waxed Cardboard	75 to ⩾120	24-54
"	Grade C, Type III	80 to ⩾120	60-
"	Films: moisture-proof Cellophane, Pliofilm, Saran, Koroseal, Ethocel or polyethylene	60 to ⩾120	--
"	Metal foils or laminates	90 to ⩾120	90- ⩾120

Table 1

Acids will decompose VPI and consequently, acidic conditions in packaging with VPI must be avoided. Normally, acids such as acidic flux residues are removed from the metal before packaging so that this limitation is not serious. Difficulty due to acid decomposition has been encountered only in a few instances —the source of the acid being certain green lumber used for boxes, leather parts of an assembly where the leather was quite acid and in contact with steel and acidic boxboard or packing which became so wet that the acid was carried through to the VPI coating. In most of these cases, it was necessary to eliminate the source of the acid, although in some, the use of barrier materials avoided the difficulty. Strong alkali (above pH 10) can also decompose VPI, but the likelihood of encountering such strong alkaline conditions in packing is quite remote.

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The protection life offered by a VPI package is primarily dependent upon the rate of vapor loss from the package. Vapor is lost both through holes or openings in the package and through the walls of the package. Openings in the package are generally avoided and are not a consideration, but even when a package is not fully closed or has been accidentally punctured, protection is usually maintained for a period of many months due to the low rate of vaporization (vapor pressure .0001 millimeters mercury at 72° F.) of the VPI coating. Loss through the walls of the package is, of course, greater the higher the temperature and the greater the wind velocity past the package, but can be substantially reduced by using any of several barrier materials as shown in Table I. Separate barrier materials give significantly greater protection against vapor loss than do barrier sheets that have been coated directly with VPI.

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In Table I is shown the months of protection that may be expected with various package structures for indoor and open shed exposure. The difference in values between these two sets of exposures reflects primarily the effect of airflow over the packages. Because VPI is most applicable for individually wrapped or cartoned parts which are generally multiple packed in an additional outer container if prolonged outdoor exposure is entailed, the indoor storage periods shown in Table I are considered to have more practical significance.

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The effect of VPI on non-ferrous metals has been extensively tested in the laboratory and many industrial concerns are using VPI where non-ferrous metals are present, but the possible variables are so great that this subject is still not fully covered. VPI has been found to protect aluminum and is being used in several places for aluminum packaging. For the other non-ferrous metals, it is necessary to distinguish between the vapor and the

(Please turn to page 80)

FILTRATION OF LUBRICATING AND COOLING OIL IN WIRE DRAWING AND STRIP ROLLING

by H. Clark Smith, Jr., General Superintendent
Wilbur B. Driver Company, Newark, N. J.
and
George Zebora
Hercules Filter Corporation
Paterson, N. J.

A dream of many years appears to have been realized in the development of an efficient filtration system for wet drawing lubricants, as set forth in this paper. There have been filters that did an insufficient job and those that over-filtered. The results from keeping lubricants clean has many practical advantages.

The normal approach to lubrication of diamond dies in wire drawing has for many years been thru the use of soluble oils which were selected for both their cooling and lubricating qualities. The disadvantages of soluble oils for this purpose are many: foaming, buildup of fats in the equipment, clogging of the jets, rust of the equipment, and interruption of production for cleaning purposes. Some mixtures turn rancid and create unpleasant working conditions. These disadvantages, of course, mean high maintenance costs in addition to production loss necessitated by shutting down equipment for thorough cleaning and removal of dirt, etc.

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The alternative to soluble oil is mineral oil with or without extreme pressure additives. These oils eliminate many of the disadvantages of soluble oils, but in turn have a number of disadvantages as follows:

1. **High initial cost.**
2. **They have the property of dispersing metal dust, diamond dust and other abrasive particles rather than allowing them to settle.**
3. **Lower heat conductivity.**

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It was felt that if a mineral oil containing sufficient E. P. additive could be obtained with a low enough viscosity and sufficient heat conductivity, the third of these objections could be overcome. Experiments with such an oil were very encouraging and produced excellent results as to die life and cooling as represented by the temperature of the wire drawing dies and the lack of burnt dies.

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The oil chosen had a mineral oil base with a viscosity of about 50 ssu at 100° F. with additions of sulphur and chlorine in a fatty oil carrier. This oil was very expensive and even though an increase in die life of 25 - 50% was obtained, it was deemed desirable to attempt to avoid replacement very few months by filtration, if possible. After a considerable experimental period, a filtration system was finally selected as shown in Fig. 1.

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This system is built around the Hercules Model #20 Pressure Leaf filter (A), which is essentially a pressurized vessel containing a number of vertical filter leaves upon which can be deposited any of a number of filtering media. Referring to figure one, you will note that

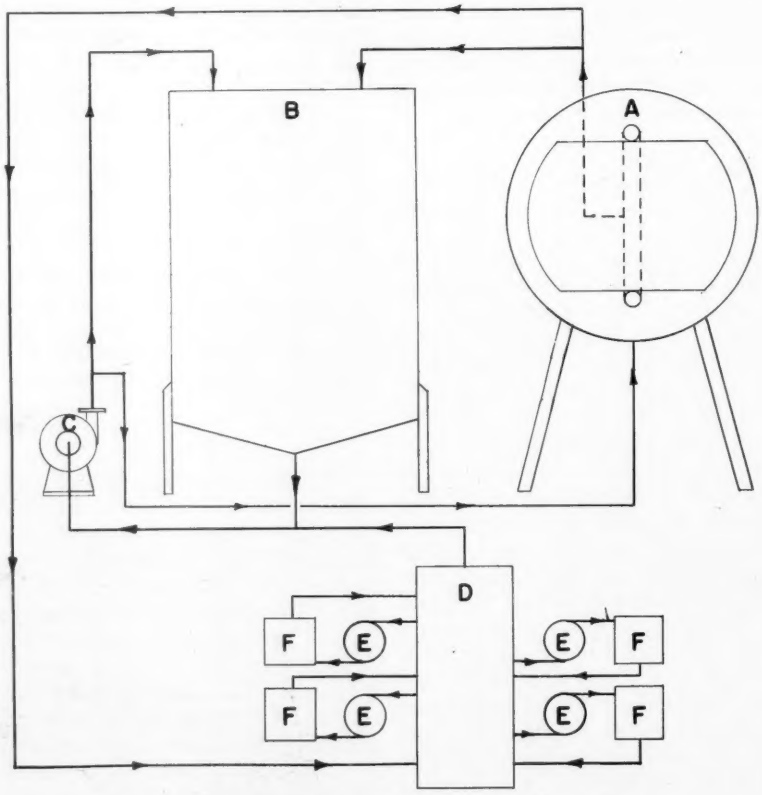

Fig. 1. — Line diagram showing typical bypass filtration setup.
A—Filter
B—Precoat tank
C—Filter pump
D—Main oil sump
E—Pumps supplying wire drawing machines
F—Wire drawing machines

the filter is used in conjunction with a precoat tank (B) and pump (C). The method of preparing the system for filtration essentially consists of mixing a slurry of filtering aids and oil in the precoat tank and pumping this thru the filter tank wherein it is deposited upon the leaves forming a filtering mat whose characteristics are determined by the substances used. In the case of this wire drawing oil, we used a mixture of asbestos and wood pulp fibers known as Chrysolite and a small quantity of diatomaceous earth. Both of these substances are inert and thus have no apparent effect upon the additive compounds while they thoroughly remove all dirt, metal and other foreign particles. Further referring to figure one, you will note that this filtration cycle is completely independent and not in any way connected with the pumps (E) handling the oil to and from the wire drawing machines (F). This is known as a by-pass method of operation.

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This system, pictured in figures two and three, is now installed upon a battery of 12 Vaughn 16CF-1, 6 Vaughn 16 CF-2 and 4 Vaughn 12 HF wire drawing machines. These machines are drawing stainless steel, nickel-chrome and other high alloy wires finishing them in the size range from .015 to .002 at speeds of approximately 1000 to 1500 ft. per minute. In practice, a sample of the sump (D) oil is centrifuged once a week and should any solids be present, the filter is shut down for cleaning. Operating experience over a period of approximately two years has shown that if the flow of filtered oil is over 10% of the flow of oil to the wire drawing machines, the body of oil is kept crystal clear. The original batch of oil installed over two years ago is kept up to level by slight additions to replace dragout. The oil is apparently in the same condition as when installed although we have once had to make a small addition of the additive material. The indication is that the maintenance of clean oil has resulted in further substantial improvement in die life. The filter cleaning cycle is approximately one to two months, and since the filtration system is a bypass one, it is not necessary to stop the wire drawing machines for cleaning the filter. The cost of the filtering materials for one charge is approximately $10.00, and since this lasts for one to two months, the cost of materials is negligible. The labor required for changing is also very minor, amounting to a maximum of two man hours.

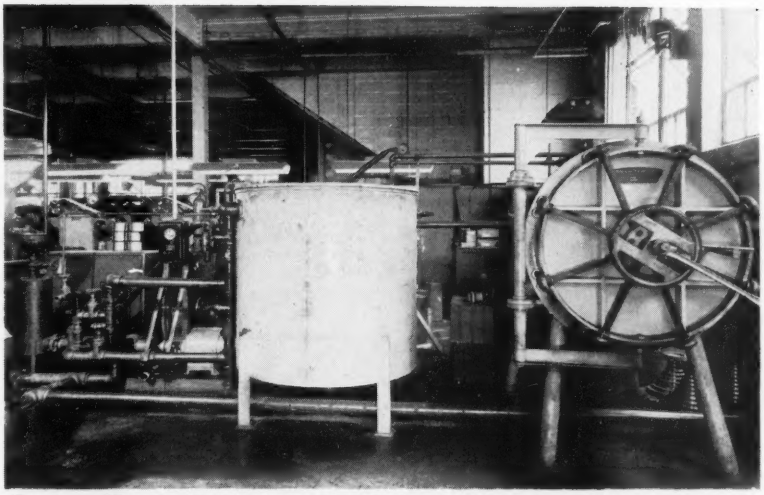

Fig. 2. — View showing Model #20 Hercules Pressure Leaf filter on right and precoat tank and pump on left.

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Because of our experience with wire drawing oils, we used a similar approach in the case of the Sendzimir Rolling Mill. In this instance, the problem was twofold:

1. **The filters with which the mill was equipped were inadequate and were directly connected in the cooling oil cycle which resulted in a decrease flow of oil as the element clogged.**
2. **Due to the development of heat in the rolling operation, the acidity of the oil continually increased requiring that the oil be discarded after a month or six weeks.**

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It was recognized from the beginning that oil used in the mill must be filtered since the roll oil also provides lubrication for the working parts of the mill, and dirty oil injected into highly precise roller bearings would obviously cause great difficulties. In addition, after a short period of operation, there was definite evidence of acid attack on certain steel and bronze working parts in the housing of the mill. This attack was believed to have been caused by formation of acid

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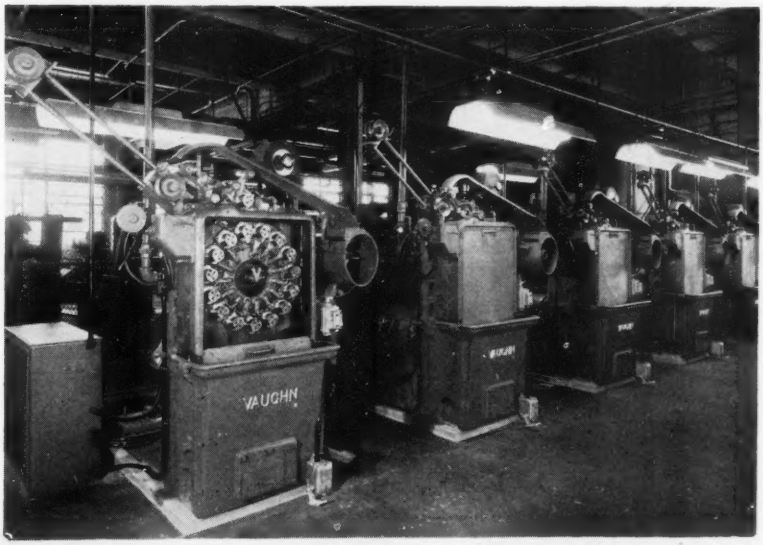

Fig. 3. — View showing several of the wire drawing machines served by this system.

Instrument Springs and Spring Instruments

by J. W. Rockefeller, Jr.
All-Weather Springs
New York, N. Y.

The author, a well-known spring engineer, here discusses the properties required in springs to make them suitable for precision instrument applications.

While the connection may at first glance seem tenuous, it is true, nevertheless, that one of the principal reasons why American made aircraft instruments have achieved their present degree of perfection is that 30 years ago the Department heads of our various State Bureaus of Weights and Measures exhibited a rare perserverence and unswerving integrity in their insistence that the American public have the benefit of more accurate weighing equipment. The tolerances on such equipment have constantly been narrowed until today in many states a spring scale used for the purpose of selling food stuffs other than fruits and vegetables must be three times as accurate as was required but a few years ago. That springs have been developed which will meet such requirements is simply one more proof of the old adage that "necessity is the mother of invention".

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The principle of the spring as a measurement of force has been known since the time of Hooke or for more than 200 years. The use of the spring in a weighing machine as a force measuring element possessed so many advantages over other means of force measurement that the accurate spring balance has for many years been the goal of most scale manufacturers. Resilience, an inherent characteristic of any spring weighing machine, shock proofs other and more delicate parts. Because of this fact spring scales stand up remarkably well under heavy duty and, compared with other types, have been notably trouble free and characterized by the absence of frequent repairs and expensive maintenance.

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As recently as 25 years ago comparatively little was known of the properties of metal springs. About that time the Spring Research Committee of the American Society of Mechanical Engineers was formed for the purpose of obtaining more factual data regarding the performance of mechanical springs and for disseminating this information among engineers and designers who, until then, had been inclined to regard with suspicion all metal springs. The writer, who served as secretary of the Committee from its formation until about seven years later was surprised at the lack of knowledge of springs not only among laymen but among designers and even mechanical engineers. The failure of the spring to retain constant elastic properties under varying atmospheric conditions, for example, was generally attributed to the thermal coefficient of expansion of the metal rather than to the effect of temperature on the elastic modulous—the actual cause. The phenomena of creep or continued deflection under applied loading and mechanical hysteresis, or the failure of the loading and unloading curves to coincide, were regarded as inherent faults of a mechanical contrivance which was considered to be temperamentally unstable at best and at worst an invitation to certain trouble. The suspicion of springs was not confined to the uninitiated. When Vincent Bendix was in the process of developing his well-known automobile self-starter, he demonstrated an early design to engineers of the Westinghouse Company. He was advised that the inclusion of a spring in this mechanism would render it inoperative and doom the whole enterprise to failure. A friction clutch was suggested as a substitute. After spending about two years in a vain attempt to apply the friction clutch principle to this mechanism, Bendix returned to a torsion spring and produced a successful starter. This incident serves as but a single example of the light in which mechanical springs were regarded by engineers.

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It is not surprising that in the field of scales, springs were also under grave suspicion and, the inclusion of a spring in a weighing mechanism was frequently regarded as an act just short of conspiracy against the consuming public. In fact, there were cities in this enlightened country where the use of a spring scale for the sale of merchandise was prohibited by statute. About the time the American So-

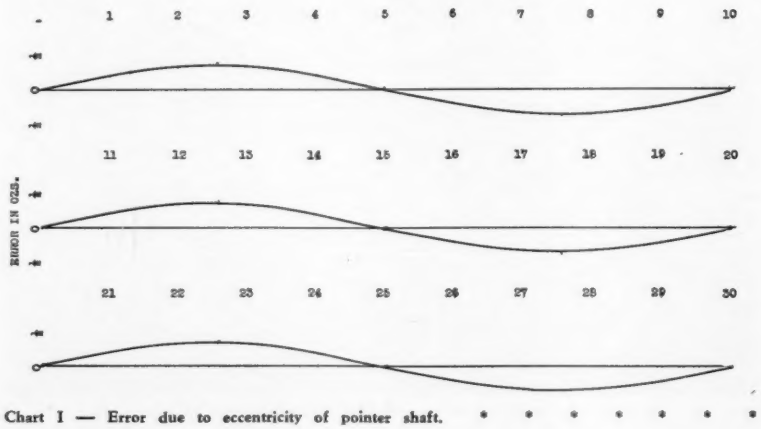

Chart I — Error due to eccentricity of pointer shaft.

ciety of Mechanical Engineers became interested in the subject of springs, a young American engineer was in Paris becoming acquainted with the work of Guillaume on constant modulous alloys. The phenomena of hysteresis and creep became subjects for scientific investigation, rather than example of the shear obstinacy of inanimate objects. Most State Departments of Weights and Measures continued to tighten up tolerances on all scales, including spring scales, so that the difference between a good scale spring and a poor scale spring became the difference between a scale which was approved and one which was condemned. The view of the Departments of Weights and Measures of most states, that they were concerned with the final accuracy of weighing machines and not how this accuracy was attained, was perhaps one of the greatest boons to the instrument spring industry and later of inestimable benefit to the entire aircraft instrument industry. Had the view been taken by these Departments that a spring in a scale was prima facie evidence that the owner and manufacturer of the scale were dishonest, it is doubtful, indeed, that the aircraft instruments used during the last war would have attained their high degree of accuracy. The consequence of such a shortcoming on the final outcome of the war is a matter for interesting speculation.

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The attitude of most State Departments of Weights and Measures, as well as that of the National Conference on Weights and Measures, appeared to be that tolerances would apply to the performance of the scale only and restrictions would not be placed on the means used in the scale's construction. When tolerances become so tight that a scale which met them in the summer would be condemned in the winter, the manufacturers of spring scales devised temperature compensating means for offsetting the effect of temperature on the elastic modulous of the steel spring. By reducing the stress in the spring and by resorting to selection of optimum materials and thermal treatment both hysteresis and creep in scale springs were brought well within legal specifications. The general improvement in scale springs, together with the fact that the spring in a scale in addition to serving as a force measuring element also absorbs shock, led most scale manufacturers to use springs rather than other means of force measurement. Among manufacturers of computing scales of the most expensive types, the use of the pendulum became less and less common and the use of springs more general.

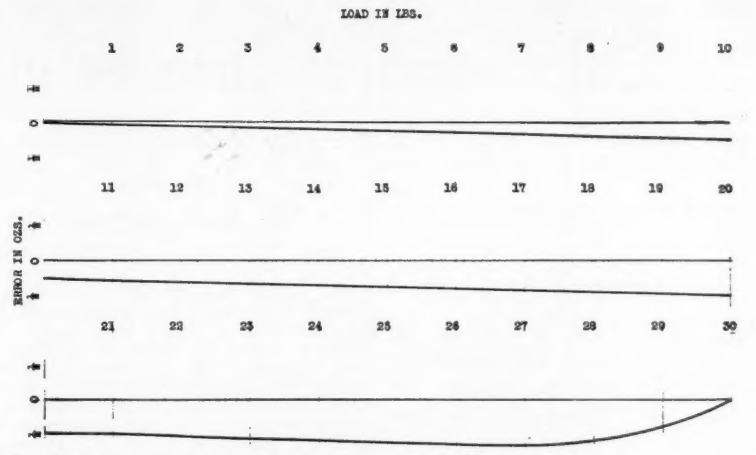

Chart II — Error due to springs lifting off runner at 26½ lb. mark.

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Elinvar wire was brought in from France about 1922 and the first elinvar springs were made in this country about that time. Because of the low working stress necessary for elinvar springs, it was impossible to substitute springs of this type for most steel springs in existing scale designs, so for another 10 years temperature compensation was generally attained through the use of some device outside the spring. Just before the last war, scale springs were being commercially manufactured of elinvar and also of a combination of modified elinvar possessing a positive thermal co-efficient of elastic modulus combined with a spring section made of steel or other material having the negative co-efficient of elastic modulous (U. S. Patent #2236158). Through a spring of this type not only was the capacity error inherent in the ordinary spring eliminated, but by properly designing the two sections the zero error in the scale, or that caused by unequal thermal expansion or contraction of the metal parts, was also eliminated. Such a spring, therefore, not only eliminated the capacity thermostat but also the zero thermostat which had previously constituted parts of

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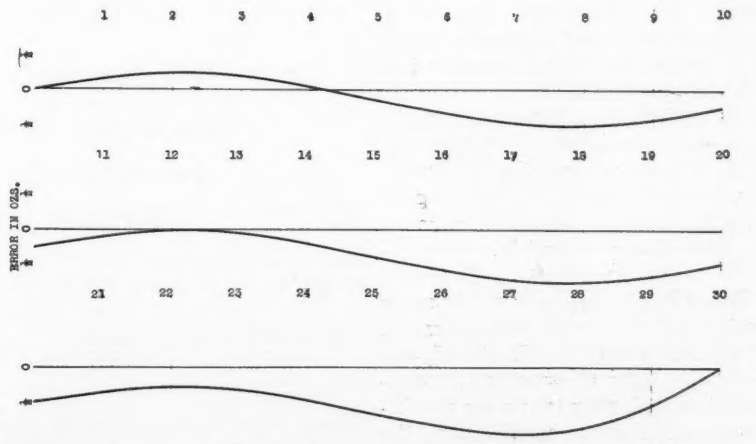

Chart III — Error due to eccentricity of pointer and springs lifting off runner.

Calculation of Stresses in Wire Ropes

By Frederick H. Hruska

Madeco

Santiago, Chile

This article was stimulated by one published in March, 1951, by Henry M. Hall on "Stresses in Small Wire Ropes". The author makes no claim to originality in his formulae, but has never seen them used. He is a Czecoslovanian engineer who founded a wire rope plant there in 1932. He was obliged by the Germans to sell his interest in World War II, following which the business was nationalized. Rather than continue with it, he went to Chile where he is now technical adviser to a large producer of copper wire, cables, etc.

The wires in a wire rope are arranged in a centric symmetry and it should be easy to calculate the stresses which arise when we put a load on the rope. The trouble is that we have a problem of distribution of forces in the space and not in a plane. We are obliged to take our three-dimensional problem to the two-dimensional papersurface and in this act we easily commit errors. We are accustomed to use the forces-paralogram in problems of distribution of forces, but the path of an individual wire in a rope is so twisted, that the use of the paralogram is very difficult. Our approach to the problem will be different.

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First, let us make clear that this article will treat only forces arising from putting a rope under tension. No bending, no twisting! A load hanging on a wire rope or strand will produce 3 types of forces in the rope or strand:

1) **A tension force in each wire.**
2) **A radial force pressing wires and strands against their respective cores.**
3) **Tangential forces which produce torques trying to "open" the strands or rope.**

★ ★ ★

We shall confine ourselves to the tension forces. They determine the total bearing section we must choose. Point 2 and 3 are also interesting and important, just as are the problems arising from bending and twisting, but it would be necessary to write a whole book. One single problem, the calculation of "non-rotating" ropes, where the different layers must be calculated to compensate their torques would be material for more than one article.

★ ★ ★

In order to make our approach easier we shall start with strands. If we take a very simple strand, one with one layer of wires and hempcore then it is easy to use the paralogram of forces considering the hempcore as not taking any part of the load. I think that I can omit the drawing of the paralogram and write directly the stress σ in the wires as follows:

$$\sigma = \frac{P}{s \cdot \cos\alpha} \qquad (1)$$

★ ★ ★

"**P**" is the load, "s" the total section of all wires and α the lay angle. This was easy, but how will the distribution be when the strand will have a wire cord and when there will be several layers of wires, each with a different lay angle? With our paralogram we are absolutely lost. Fortunately, there exists a method which will give us what we need without difficulty.

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Let us imagine a strand of any length and of any type, all wires made from the same material and, therefore, with the same modul of elasticity "E". We shall assume, that all the wires of one layer will have exactly the same length. Setting in the stranding machine the same tension on all wires we endeavour to

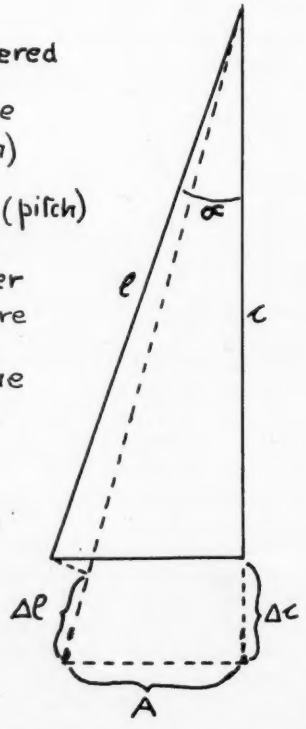
α = Lay angle of wire considered

ℓ = Length of outer wire in one lay (pitch)

τ = Length of core wire = lay (pitch)

$\Delta\ell \neq \Delta\tau$ = Elongation of outer wire and core wire

$A = D\pi$, where D means the diameter of the circle formed by the centers of the wire considered



reach this ideal state.

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On putting a load on the strand, it becomes longer. At the ends the position of the individual wires will not change, if we take care to impede the rotation of the strand under load. With rotation we would get a completely different distribution. So all wires get the same elongation in the **direction of the axis of the strand.** The following diagram represents the lengths of the core wire and one outer wire before and after stressing.

This diagram will give us:

$$(l + \Delta l)^2 = A^2 + (c + \Delta c)^2$$
$$l^2 + 2l\,\Delta l + \Delta l^2 = A^2 + c^2 + 2c\,\Delta c + \Delta c^2$$

Δl^2 and Δc^2 are numbers of second order and can be dropped. The variation of α (exaggerated in the diagram) and that of A are of the same order and need not be considered. As $l^2 = A^2 + c^2$ we finally obtain:

$$\Delta l = \Delta c \frac{c}{l} = \Delta c \cdot \cos\alpha \qquad (2)$$

★ ★ ★

Assuming that we stay within the validity of Hook's law the stresses in core and outer wire will be

$$\sigma_c = \frac{\Delta^2}{c} E$$

and $\sigma_l = \frac{\Delta l}{l} E$. Introducing these values in (2) we get:

$$\sigma_l = \sigma_c \cdot \frac{c^2}{l^2} = \sigma_c \cdot \cos^2\alpha \qquad (3)$$

★ ★ ★

The result shows that the core wire takes a greater part of the load than corresponds its section. The stress in the outer wire depends on its lay angle. The stress in the core wire is $\frac{l}{\cos^2 \alpha l}$ higher than in the layer with the angle "α".

★ ★ ★

The user or maker of wire ropes need not worry too much as "α" is always small and cos α therefore not far from "one". In a 6 + 1 strand for instance, with a lay of 10, $\frac{1}{\cos^2 \alpha}$ will be 1.044, that is, the core wire will be more stressed 4.4%.

★ ★ ★

Nevertheless, it is important, that anybody who has to deal with wire ropes should know that the wire core in a strand is **always** more stressed than the surrounding wires. In some countries there even exist standards which exclude the central wire from the bearing section in application where high security is important (airplanes, mining). In practice it can be considered to be exagerated, but the principle is correct.

★ ★ ★

According to this result we would expect, that core wires break first, but we know that they definitely do not. This can be easily explained. The outer wires are subject to abrasion and to high pressure in the sheaves. The high local pressure flattens the wire, producing an effect of workhardening and other changes of structure, (see forming of martensite, Wire and Wire Products of October 1948). The inside layer of Seal, Warrington ropes and so on are another example of the fact that the tension stress is not everything. These wires cabled together with the outer layer have small lay angles and are therefore more stressed. But their protected position inside the strand more than outweighs the higher stress to which they are submitted.

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Now, we know the relation between stresses in the core and the other wires. That is not enough. What we need is the absolute amount of stresses. For this purpose let us write the formula which shows us the load as the sum of all components of the tensions in the wires in the direction of the strand axis.

$$P = S_c \cdot \sigma_c + S_1 \cdot \sigma_1 \cos\alpha_1 + S_2 \cdot \sigma_2 \cdot \cos\alpha_2 \qquad (4)$$

★ ★ ★

S_c = section of the core wire
$S_1, S_2 \ldots$ = total section of wires in in layers 1,2, ...
σ_c = stress in core wire
$\sigma_1, \sigma_2 \ldots$ = stresses in wires of layers 1,2, ...

Introducing formula (3) into (4) we obtain:

$$P = \sigma_c (S_c + S_1 \cdot \cos^3\alpha_1 + S_2 \cdot \cos^3\alpha_2 \cdots) \qquad (5)$$

As the different sections and angles are determined by the construction of the strand, it is easy to compute the stress in the core δ_c with a given load. Once σ_c is known, we can calculate the stresses in the other wires by means of formula (3).

★ ★ ★

When all wires are stranded with the same angle then we come to a simpler shape, where S signifies the total section of the strand, with exception of the core wire section:

$$P = \sigma_c (S_c + S \cdot \cos^3\alpha) \qquad (6)$$

★ ★ ★

Up to now, we considered only strands with wires of one metal. In practice we find cases where this is not true, as for instance aluminum conductors with steelcores or field telephone cables, which are made of steel wires with copper core. In these cases formula (3) changes to

$$\sigma_l = \sigma_c \cdot \cos^3\alpha \cdot \frac{E_l}{E_c} \qquad (7)$$

Where E_l and E_c are the respective moduli of elasticity. Formula (5) changes to

$$P = \sigma_c \left(S_c + S_1 \cdot \cos^3\alpha_1 \frac{E_{l_1}}{E_c} + S_2 \cdot \cos^3\alpha_2 \frac{E_{l_2}}{E_c} + \cdots\right) \qquad (8)$$

and with the same lay angle for all layers:

$$P = \sigma_c \left(S_c + S \cos^3\alpha \frac{E_l}{E_c}\right) \qquad (9)$$

★ ★ ★

When the strand has a hemp core where $\sigma_c = 0$, we can substitute σ_c by σ_1 of any layer we might choose. Making use of the diagram by adding a line with another lay angle we shall see formula (3) transformed into

$$\sigma_{l_2} = \sigma_{l_1} \cdot \frac{\cos^2\alpha_2}{\cos^2\alpha_1} \qquad (10)$$

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I think, that will do as far as strands are concerned. If anybody is interested in the less frequent cases of multi-layer strands with hemp cores or their most improbable variation with different materials in the different layers, there is no diffi-

(Please turn to page 799)

PROGRAM

Annual Convention of The Wire Association
La Salle Hotel, Chicago, Ill., October 22-25, 1951

The Wire Association's Headquarters at the La Salle Hotel
Will be Open from Monday, October 22nd, Every Evening During the Convention
Come and Get Acquainted!

THERE WILL BE A REGISTRATION FEE OF $6.00 FOR THOSE ATTENDING THE TECHNICAL SESSIONS AND INFORMAL MEETINGS.

ADMISSION WILL BE BY BADGE ONLY—PLEASE WEAR IT.

Discussions will be held on the papers presented and these discussions will be published in the January, 1952, issue of Wire and Wire Products.

THE WIRE ASSOCIATION PROGRAM COMMITTEE FOR THE 1951 CONVENTION

Ralph B. Roth
Vice President
Ludlow-Saylor Wire Co., St. Louis, Mo.
GENERAL CHAIRMAN

FERROUS DIVISION
CHAIRMAN
John A. Moritz, Supt., Wire Mills
Keystone Steel & Wire Co., Peoria, Ill.

COMMITTEE MEMBERS

Fred H. Parkin, Partner
The Parkin Chemical Co.
Pittsburgh, Pa.

Tom M. Girdler, Supt.
Union Drawn Steel Div.,
Republic Steel Corp.
Beaver Falls, Pa.

Leonard C. Crewe, Jr., Pres.
Maryland Fine & Specialty Wire Co.
Cockeysville, Md.

All papers presented at this Convention by members of The Wire Association are eligible for consideration for the Annual Medal Award, and will be voted upon by the Board of Directors at the next Spring meeting of that body.

NON-FERROUS DIVISION
CHAIRMAN
Bruce W. Gonser, Research Supervisor
Battelle Memorial Institute, Columbus, O.

COMMITTEE MEMBERS

Joseph E. Wiltrakis, Asst. Supt., Mfg. Eng.
Western Electric Company
Kearney, N. J.

Kenneth Gillette, Vice Pres.
Industrial Ovens, Inc.
Cleveland, Ohio

Frank R. Nichols, Pres.
Nichols Wire & Aluminum Co.
Davenport, Iowa

GENERAL ACTIVITIES

ENTERTAINMENT
Eber J. Hubbard, Vice Pres.
Hubbard Spool Company
Chicago, Ill.

EXECUTIVE SECRETARY
Richard E. Brown
The Wire Association
Stamford, Conn.

REGISTRATION
R. S. Spengel, Asst. Exec. Secy.
The Wire Association
Stamford, Conn.

Technical papers are preprinted in the October issue of Wire and Wire Products insofar as possible. Titles to papers accepted will be given to the Wire Association and duly copyrighted at the time of publication.

All wire mill men and suppliers are invited to attend this meeting, see how the Association functions and participate in the activities.

Hotel reservations should be made by members of the Wire Association direct to the Secretary.
MAKE YOUR PLANS NOW TO ATTEND AND SEND YOUR RESERVATION PROMPTLY

MONDAY, OCTOBER 22nd

9:00 A. M.	10:30 A. M.	12:30 P. M.
REGISTRATION	DIRECTORS' MEETING	PROGRAM COMMITTEE LUNCHEON

THE CONVENTION PROGRAM

La Salle Hotel, Chicago, Ill., October 22-25, 1951

MONDAY, OCTOBER 22nd

9:00 A.M. Registration Desk opens on the mezzanine floor.

10:30 A.M. Annual Meeting of the Board of Directors of the Wire Association.

12:30 P.M. Directors' Luncheon for Program Participants.

2:00 P.M. Technical Session—Joint Meeting for Both Ferrous and Non-Ferrous Groups.

Chairman of Meeting
Ralph B. Roth, Vice Pres.
Ludlow Saylor Wire Co., St. Louis, Mo.

Address of Welcome by Fred M. Crapo, President, The Wire Association

PAPER:
"Communications Wire Program of the Signal Corps."
Methods and manner of procurement of wire and cable. Present and probable future needs of these items.
by Major Elton D. Vaughan
Signal Corps, U. S. Army
Philadelphia, Pa.

PAPER:
"Composite Insulation of Polyethylene and Nylon as Protective Jackets."
Coatings used on assault wires with special reference to WDI. Methods of processing will be discussed.
by James E. Flood, Chem. Eng.
Plastic Wire and Cable Corp.
Jewett City, Conn.

PAPER:
"High-Strength Copper-Silver, Copper-Iron and Copper - Iron - Chromium Wire."
New copper-base alloys have been made into wire for the Signal Corps, embodying unusual properties. Iron as a reinforcing fibre is a new concept in wire making.
by Webster Hodge
Ralph A. Hoppe
Bruce W. Gonser
Battelle Memorial Institute
Columbus, Ohio.

TUESDAY, OCTOBER 23rd

FERROUS SECTION

Morning Session—9:30 A. M. Chairman of Meeting: Fred H. Parkin, The Parkin Chemical Co., Pittsburgh, Pa.

PAPER:
"A Progress Report on the Development of the Wheelabrator Mechanical Cleaning Process."
Sulphuric acid shortage makes consideration of dry-cleaning desirable. Covers cold rolling and drawing.
by Gilbert H. Dill, Sales Eng., Charge, Steel Division
American Wheelabrator and Equipment Corporation
Mishawaka, Ind.

PAPER:
"Depolarizing Agents and Their Effects and Savings in Cleaning of Rods and Wire."
Addition of depolarizing agent to acid will save acid, speed pickling and increase adherence of secondary coatings.
by Joseph T. Irwin, Chemist,
Azed, Inc., Div. of Promat Div. of Poor and Company
Waukegan, Illinois

NON-FERROUS SECTION

Morning Session—9:30 A. M. Chairman of Meeting: J. H. Gillette, V. P., Industrial Ovens, Inc., Cleveland, O.

PAPER:
"Process Control for Enameling Copper Magnet Wire."
Illustrates and describes the controls essential to operate a wire enameling plant. Automatic viscosity and temperature controls discussed.
by R. F. Thompson, Supervisor, Engineering & Development, Copper Wire Department, Westinghouse Electric Corp.
Buffalo, New York

PAPER:
"Catalytic Combustion of Wire Enameling Fumes."
Shows how fuel costs, shut-downs, air pollution and fire hazards can be reduced in wire enameling operations.
by R. J. Ruff, President
Catalytic Combustion Corp.
Detroit, Michigan

PAPER:
"Fiberglas Textiles in the Wire and Cable Industry."
Fiberglas textile applications to electric wire—performance properties, economics and new developments.
by W. Kenneth Lydic, Research Eng.
Ashton Laboratory
Owens-Corning Fiberglas Corp.
Ashton, Rhode Island

TUESDAY, OCTOBER 23rd (Cont'd)

FERROUS SECTION

Afternoon Session—2:00 P. M.

Chairman of Meeting: Tom M. Girdler, Jr., Supt., Union Drawn Steel Division, Republic Steel Corporation, Beaver Falls, Pennsylvania

PAPER:
"Maintenance and Improvement of Quality Cold Heading Wire."

Factors affecting cold heading properties and methods adopted at Keystone to improve the quality of such wire.

by Lester R. Fanks, Wire Mill Met. and John Harrigan, Chf. Metallographer
Keystone Steel and Wire Co.
Peoria, Illinois

PAPER:
"Problems and Progress in the Manufacturing of Bolts, Nuts, Etc."

From the maker's point of view—the problems of fabricating fasteners.

by William E. Hill, Jr., Plant Supt.
Russell, Burdsall and Ward Bolt and Nut Co.,
Rock Falls, Illinois

NON-FERROUS SECTION

Afternoon Session—2:00 P. M.

Chairman of Meeting: Joseph E. Wiltrakis, Asst. Supt., Mfg. Eng., Western Electric Co., Kearney, N. J.

PAPER:
"Rigid Polyvinyl Chloride Insulations."

These new insulations provide advantages not achieved by plasticized compounds. Their characteristics are set forth in the paper.

by Willard de C. Crater, Asst. Mgr., Vinyl Sales
Naugatuck Chemical Div.,
U. S. Rubber Company
Naugatuck, Conn.

PAPER:
"Cellulosic Coatings for Braided Insulated Wire."

Qualities and characteristics of lacquers used for wire coatings.

by William J. McGowan, Vice Pres.
New England Lacquer Company
East Providence, R. I.

PAPER:
"The Preparation of Dry Blend PVC Compounds for Extrusion."

Describes new blending process that eliminates previous difficulties of clogged screens and porosity. Slides illustrate principles of operation.

by Sidney R. Dresser, Manager,
Wire Mill Division
Mercer-Robinson Company
New York, N. Y.

WEDNESDAY, OCTOBER 24th

FERROUS SECTION

Morning Session—9:30 A. M.

Program Chairman: L. C. Crewe, Jr., Pres., Maryland Fine and Specialty Wire Co., Cockeysville, Md.

PAPER:
"Wet Chemical Blanket for Hot Galvanizing Surfaces."

Paper sets forth possible savings in zinc spelter in continuous hot dip galvanizing by use of a wet chemical blanket.

by A. A. Paterson, Sales Eng.
Dewey & Almy Chemical Co.
Chicago, Illinois

PAPER:
"Patenting with Continuous Cleaning and Coating."

This paper traces rods through various stages of preparation for drawing, discussing practices that make for good wire.

by C. H. Williams, Jr., Wire Mill Supt.
Pittsburgh Steel Company
Monessen, Pennsylvania

NON-FERROUS SECTION

Morning Session—9:30 A. M.

Program Chairman: Frank R. Nichols, Pres., Nichols Wire & Aluminum Co., Davenport, Ia.

PAPER:
"The Aluminum Situation."

Describes the factors currently affecting the current civilian supply of aluminum and what is being done to improve the future supply.

by J. H. DeKlyn, Mgr., Massena Operation
The Aluminum Co. of America
Massena, New York

PAPER:
"How Development and Research Have Created New Markets for Nickel Base, Nickel Chromium and Chromium Iron Alloys."

Paper will show why both development and production of these alloys can best be done by a small producer.

by D. M. Schmid, Vice Pres. & Gen. Mgr.
Alloy Metal Wire Co., Inc.
Prospect Park, Pa.

WEDNESDAY, OCTOBER 24th (Cont'd)

THE ANNUAL WIRE ASSOCIATION LUNCHEON—THE MORDICA MEMORIAL LECTURE

1:00 P. M.
LADIES INVITED

LADIES INVITED

"The Fabricating of Copper Wire"
delivered by
Sidney Rolle, Assistant Manager, The Scomet Company, New York, N. Y.

THE PRESENTATION OF AWARDS FOR 1950

Medal Award to Curtis Voigtlander, Superintendent of Wire Mills, Union Wire Rope Corporation, Kansas City, Mo. for the "most meritorious" paper: "Borax as a Coating for Drawing High Carbon Steel Wire."

Certificate of Honorable Mention to W. L. Wells, Assistant Superintendent, Wire Mill, Scovill Manufacturing Company, Waterbury Conn., for his paper: "The Production and Application of Copper-Base Alloy Wire."

Certificate of Honorable Mention to Walston Chubb, Jr., Fellow, Missouri School of Mines and Metallurgy, University of Missouri, Rolla, Mo., for his paper: "Investigation of the Weavability of Wire with Observations on the Defects of Wire and Wire Cloth."

4:00 P. M.—THE ANNUAL MEETING OF THE WIRE ASSOCIATION

This is the annual business meeting of members of the Association. Your personal attendance is needed and urged.

Chairman of Meeting
Fred M. Crapo, Pres.
The Wire Association

EVENING:

THE ANNUAL SMOKER—DINNER

6:30 P. M. Cocktail Bar Opens
7:30 P. M. Dinner and Show

Chairman, Entertainment Committee: Eber J. Hubbard, Jr., Hubbard Spool Company, Chicago, Ill.

THURSDAY, OCTOBER 25th

PLANT INSPECTION TRIP

to the Wire Mills of the
American Steel and Wire Company, Subsidiary of
United States Steel Company
at Joliet, Illinois

10.30 A. M. Busses will leave the La Salle Hotel promptly to convey visitors to Joliet. Please be sure to have secured tickets for this trip by Wednesday evening.

Luncheon will be served to those making the trip in Joliet through the courtesy of the American Steel and Wire Company. Busses will be back at the Hotel at about 5 P. M.

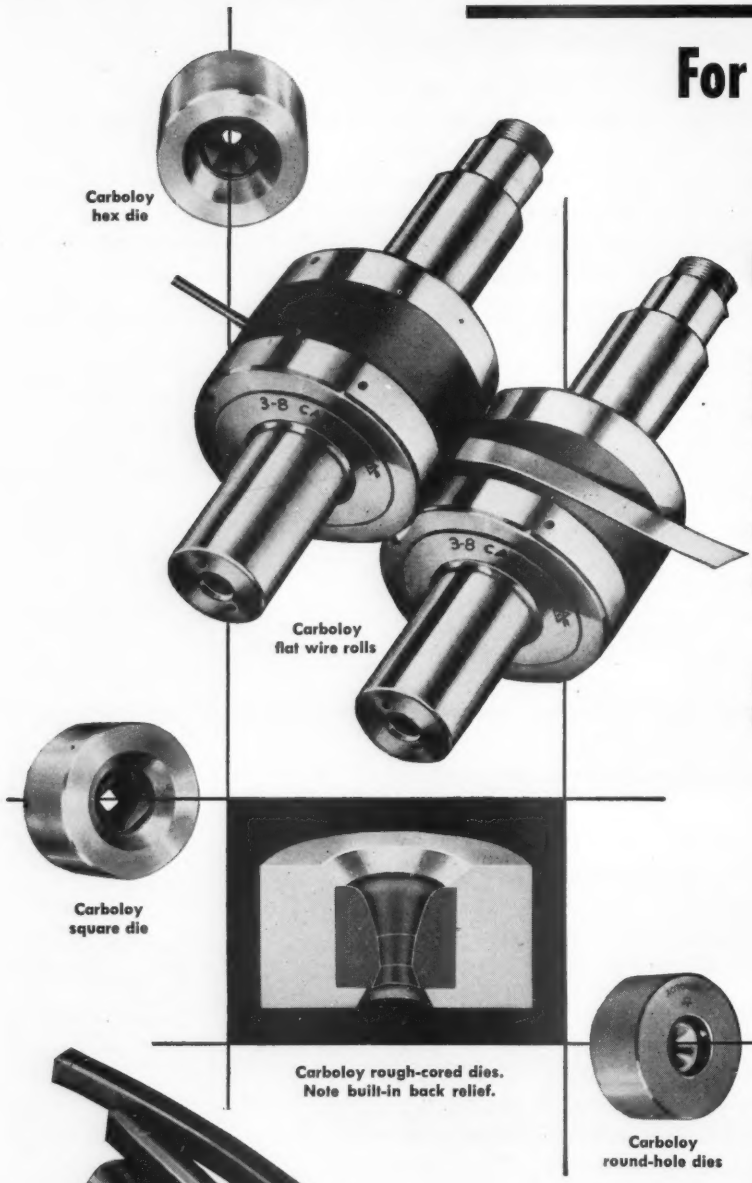
This Plant Inspection Trip Concludes the 1951 Convention

RESEARCH PAPERS ARE PREPRINTED IN THE OCTOBER ISSUE OF WIRE AND WIRE PRODUCTS
The Discussions and the Mordica Memorial Lecture will be printed in the January issue of Wire and Wire Products

Papers not received in time for preprinting will be published in the November and December issues of Wire and Wire Products.

PICK CARBOLOY

For best possible finish, more wire per die, more refinishes per di



It almost goes without saying that Carboloy W Dies, of Carboloy Cemented Carbide—*hardest me made by man*—guarantee you smooth, uniform w —always. They give you *measurable* savings, t

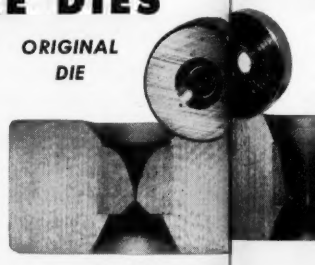
Nib wear resistance assures you more miles wire between resizes. Specially designed forg casings and high-quality carbide nibs permit m refinishes through more hole sizes—a real plus longer die life and lower die cost per mile of wi

Quality never varies

Everything possible is done to assure the b possible performance in *every single die.* A va

REFINISH CARBOLOY WIRE DIES

Unretouched photograph of Carboloy R2 wire die as delivered to manufacturer. Nib of Carboloy Cemented Carbide has starting hole size of .004″ and maximum recommended hole size of .128″.



Specify

WIRE DIES!

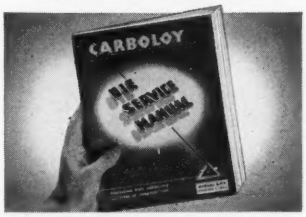
ntegrated program of 1) continuing research, 2) constant carbide grade improvement to meet metallurgical developments, and 3) constant production facility improvement produces the right combination of the best materials and manufacturing methods to insure superb, never varying quality.

Twenty-nine rigid tests

During and after production, *every single Carboloy* die must pass twenty-nine rigid quality tests with flying colors. Then, to help you conserve your dies and get from them everything we build into them, we have established a free, four-part service program (briefly outlined just to the right). For more information about the Carboloy Service Program or about the types of Carboloy Wire Dies in which you're interested, write us today.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
1171 E. 8 MILE BLVD. • DETROIT 32, MICHIGAN

Carboloy Service Program helps you conserve vital carbide dies

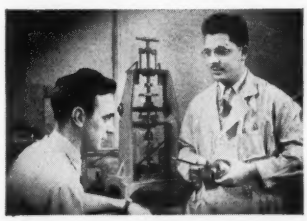


TECHNICAL LITERATURE

Complete, illustrated Die Service Manual shows how to maintain carbide dies for extra production, savings, longer die life. Also discusses die room layout and operation and die room accessories.

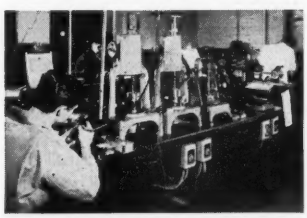
FIELD ENGINEERS

Twelve Carboloy Field Engineers with more than 200 years of experience in the wire die field stand ready at any time to help you get maximum die life and productivity.



TRAINING SCHOOL

Tuition-free instruction is available at all times to teach your key personnel latest carbide die applications and maintenance methods. Located in Detroit.

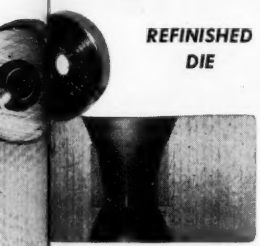


DIE SERVICE CENTERS

Their extensive facilities, in Detroit, Chicago, and Pittsburgh, are available to help you solve your toughest resizing and refinishing problems.

"Carboloy" is the trademark for the products of Carboloy Department of General Electric Company

to larger and larger hole sizes



REFINISHED DIE

Unretouched photo of used R2 die. It has been refinished and refinished to successively larger hole sizes, providing virtually a new, long-wearing die for each size. Hole size is now .202"—*almost twice recommended maximum*—with die still going strong.

CARBOLOY CEMENTED CARBIDE WIRE, BAR AND TUBE DRAWING DIES

Government Wire Production Information

Copper and Copper-Base Alloy Orders Amended

As of July 1st, NPA orders Nos. M-11, M-12 and M-74 have been amended. Under these changes, copper, beryllium copper, and brass rod, bar, shapes, wire and welding rod three feet or less in length, are affected. No producer shall be required to accept authorized controlled materials orders for any type or size of wire mill product in any one month in excess of 80 per cent of his scheduled monthly production. All such orders must specify shipment on a particular date or in a particular month, which in no case may be earlier than the date required by the person placing the order. Producers need not accept an order received less than the number of days prior to the first of the month in which shipment is requested, as set forth in Schedule 3 of CMP Regulation No. 1, unless specifically directed to accept is by the NPA. All copper mill products should be measured by the weight in pounds of the copper content of the rod, wire, etc. All persons subject to the order shall preserve the records they have maintained of production, inventories, receipts, deliveries and uses of copper forms defined in the orders. Communications regarding an order are to be addressed to the National Production Authority, Washington 25, D. C. with a notation as to the order referred to, as: Ref.: M-12, etc.

★ ★ ★

Mineral Market Report No. 1985

The Interior Department, in its Mineral Market Report No. 1985, states that copper production in the U. S. has reached a high not equalled since 1944. The rise was accelerated partly in response to defense mobilization speed-up pressure as a result of the Korean war.

★ ★ ★

Refinery output from foreign ores and imports of refined copper also are listed as the highest since 1945. Various copper mine outputs and that of domestic smelters and refiners is said in the report to have jumped 20 to 32% over 1950.

★ ★ ★

In the July meeting of the Tool Steel Industry Advisory Committee, the N.P.A. told the committee that sufficient tungsten would be available, provided present production levels were not exceeded in the third quarter. Increased domestic production plus large imports of tungsten ore from sources other than China are chiefly responsible for the brighter tungsten supply outlook. Cobalt, due to its need in building jet engines, will be in poorer supply in this quarter. The

MICROMETER PRECISION — MICRO-WELD — TRADE MARK REGISTERED

MODEL M-T, FOR BENCH MOUNTING

This welder was designed and developed expressly for welding all types of fine wire: Aluminum, Copper, Brass, Bronze, Steel and Steel Alloys, ranging in size from .005" to .020" diameter.

Unit design of frame, transformer and power sub-assemblies permit other range of sizes to suit requirements.

Equipped with a temperature indicating annealing and tempering device, voltage regulator and meter to compensate for voltage fluctuation, wire cutters, extra large 5" diameter magnifying glass, fluorescent light and extension cord. Welder can be supplied for bench mounting, or mounted on 4-wheel truck.

The adaptability of this unit for welding all types of wire, either ferrous or non-ferrous, in sizes from .005" to .020" diameter, makes it ideal for the fine wire manufacturer.

MICRO PRODUCTS CO.,

20 NO. WACKER DR., CHICAGO 6, ILL.
Telephone: STATE 2-7468

use of this metal in certain tools is to be dropped and no more than 5% used in other tools.

★ ★ ★

In an instruction to M-1, the NPA has advised industry that certain stainless and alloy steel products have been added to the list of set-asides. The set-asides vary from 85% to 100% for stainless steel products. All other alloy products with not less than 20% nickel have a 100% set-aside.

★ ★ ★

At a Brass Mill 1AC meeting the NPA reviewed a newly begun program for allocating copper raw materials to brass mills on the basis of the average monthly amount of controlled materials consumed by individual producers in the 42 months preceding mid-1950.

★ ★ ★

Book on Defense Activities

A new "Handbook on Emergency Defense Activities" listing principal functions of federal agencies handling various phases of the mobilization and defense programs is now available from the Publications Section of the New York regional office of the **U. S. Department of Commerce**, 42 Broadway, New York 4, N. Y.

★ ★ ★

The 115-page handbook, including names and addresses of key officials of the defense agencies, also contains a list of sources of information about non-defense agencies.

★ ★ ★

Mr. John F. McKiernan, director of the New York regional office of the Department of Commerce, said businessmen, Chambers of Commerce and trade organizations would find the handbook particularly useful when communicating with government agencies on defense matters.

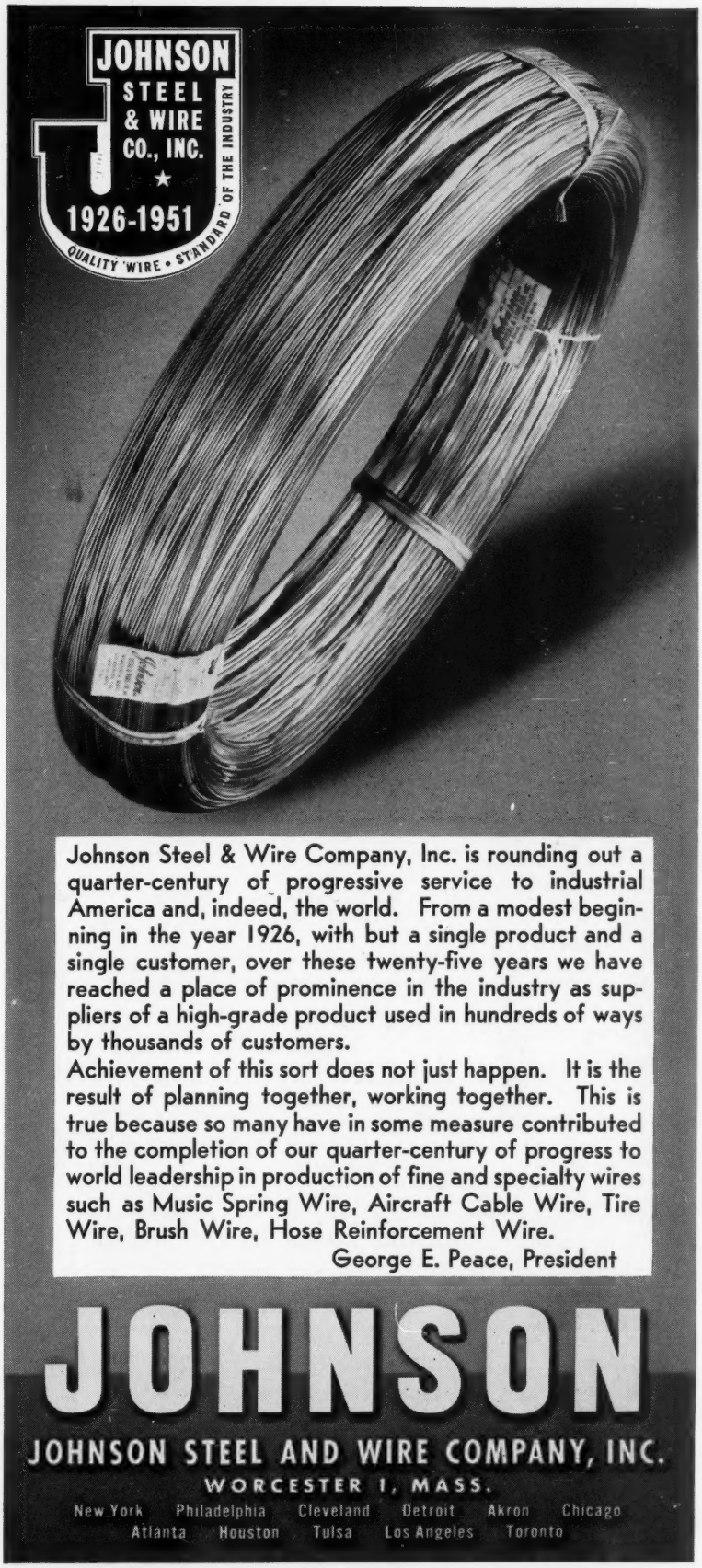
★ ★ ★

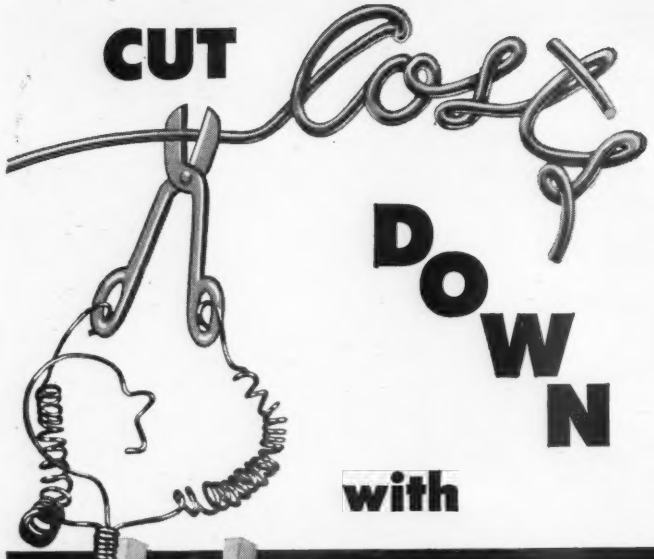
The price of the handbook is 25 cents per copy.

★ ★ ★

2200 Bolts Per Hour Separated With G-E Magnetic Comparator

A General Electric magnetic comparator, installed in a specially-designed test bench at Russell, Burdsall & Ward Bolt and Nut Company, Rock Falls, Ill., enables one operator


JOHNSON
STEEL
& WIRE
CO., INC.
★
1926-1951
QUALITY WIRE • STANDARD OF THE INDUSTRY
Johnson Steel & Wire Company, Inc. is rounding out a quarter-century of progressive service to industrial America and, indeed, the world. From a modest beginning in the year 1926, with but a single product and a single customer, over these twenty-five years we have reached a place of prominence in the industry as suppliers of a high-grade product used in hundreds of ways by thousands of customers.
Achievement of this sort does not just happen. It is the result of planning together, working together. This is true because so many have in some measure contributed to the completion of our quarter-century of progress to world leadership in production of fine and specialty wires such as Music Spring Wire, Aircraft Cable Wire, Tire Wire, Brush Wire, Hose Reinforcement Wire.
George E. Peace, President
JOHNSON
JOHNSON STEEL AND WIRE COMPANY, INC.
WORCESTER 1, MASS.
New York Philadelphia Cleveland Detroit Akron Chicago
Atlanta Houston Tulsa Los Angeles Toronto



KEYSTONE
MUSIC
SPRING WIRE

The uniformity of Keystone Music Spring Wire cuts costs and simplifies production problems in the manufacture of intricate springs and parts.

The structural soundness and uniformity of this quality wire is attained by careful selection of raw materials, slow and meticulous processing and constant examination throughout its manufacture. Rigid final inspections include coiling, torsion and bend tests to assure you finished products of the highest quality.

MARKET *YOUR* SCRAP NOW!
Houseclean your plant for all worn out and obsolete equipment. Sell it to your local scrap dealer now in order to keep America's steel production expanding.

KEYSTONE
STEEL & WIRE CO.
SPECIAL ANALYSIS WIRE. SETTING NEW STANDARDS OF PERFORMANCE
PEORIA ILLINOIS

to separate mixed bolts at a rate of 2200 an hour.

★ ★ ★

According to **C. K. Hayward,** chief metallurgist of the company, unseparated bolts previously were sold at the classification of the lowest grade material in the mix, meaning considerable loss. To eliminate this, the company had to separate large numbers of bolts from mixes of differing material, a costly and time-consuming process.

★ ★ ★

To facilitate the sorting operation, Mr. Hayward designed and built a special testing bench, incorporating the G-E magnetic comparator.

★ ★ ★

Basically an impedance comparator, the G-E device correlates, through the use of standard or reference specimens, the chemical and physical properties of the bolts being separated with the electrical and magnetic characteristics. Variations are shown on an indicator.

★ ★ ★

The comparator is recessed in the test bench to make it easy for the operator to see the indicator. The testing coil is set in flush with the bunch top so that the operator does not have to lift the bolts into the coil, but simply drops them in.

★ ★ ★

In one recent instance, Mr. Hayward reported, a customer rejected $7,500 worth of bolts because of mixed content. A single operator, using properly co-ordinated hand work together with the special comparator test facilities, was able to separate the entire lot of 150 kegs (each containing approximately 1500 bolts) at a rate of 2200 an hour.

★ ★ ★

PRICE REDUCTION!

Because of greatly reduced selling cost, we are able to reduce the price of Magnus Wire Coating Compound #267 by 2¢ per pound. The new price is 10 9/10¢ per pound, F.O.B., Garwood, N. J.

MAGNUS
CHEMICAL CO., INC. Garwood, N. J.

New Kit Aids Spring Manufacturers

Lundahl Corporation of Hartford, Conn., announces a well designed set-up kit with which the Spring Manufacturer can save time and money in preparing spring-making machines for production.

★ ★ ★

Carl Dahl, President of the Lundahl Corporation, states that the kit is the result of years of experience in developing spring-making tools and it is offered to meet a definite demand from Spring Makers.

★ ★ ★

The kit is composed of a mahogany cabinet containing a complete set of carbide tools in regular graduations. These tools cover the complete standard size range of the spring-making machine for which it is designed. Tools for oversize diameters can be furnished.

★ ★ ★

With this kit, the operator can set up his machine without lost time looking for the correct size arbor, coiling point, or other carbide tools for his machine.

★ ★ ★

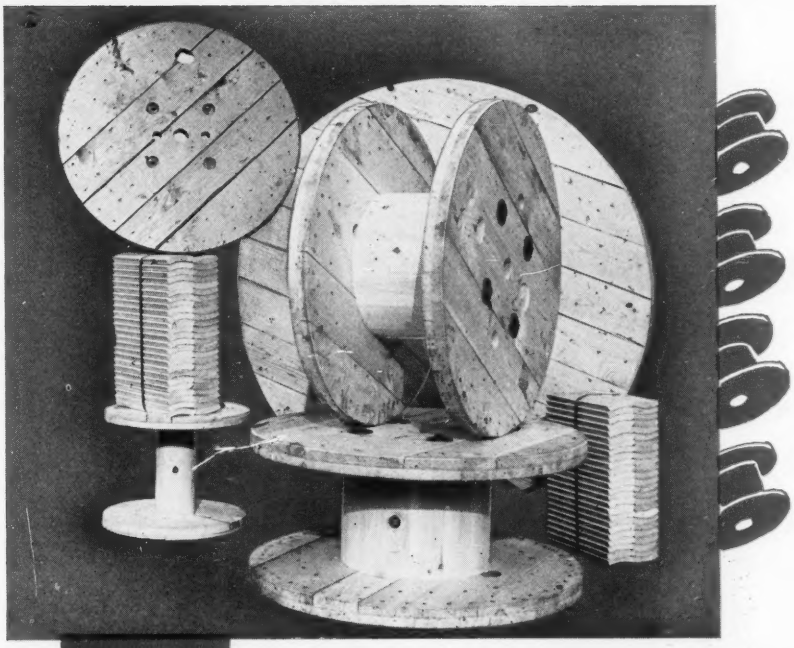
The kit also includes a highly efficient, high-speed grinder fitted with a 4½ inch diamond wheel and also a 4½ inch silicon carbide grinding wheel of proper grades. With this grinder the operator can touch up the tools with which he is working or make intermediate size tools not formed by the standard sizes in the tray.

★ ★ ★

The cabinet is portable and can be carried directly to the machine for set-up purposes, or it can be kept in the tool crib and the tools can be supplied to the operator from there.

★ ★ ★

This set-up kit is one of many products of the Lundahl Corpora-



FOR

CABLE

ROPE

WIRE

ALL SIZES AND TYPES.
SHIPPING AND SHOP REELS.

WOOD REELS

RETURNABLE AND NON-RETURNABLE

BRIDGE REELS are LOW IN COST, RUGGED in CONSTRUCTION for SEVERE HANDLING, and WELL MADE.

Our trucks will deliver reels to your door if you are within 200 miles of Hazardville. Fast freight service will reach points as far away as St. Louis in 4 or 5 days. Even better to points like Buffalo and Cleveland.

SIZES: FROM 12" to 96" IN DIAMETER

ALSO, REEL HEADS FOR STEEL DRUMS

Our streamlined production methods give you reels of the best possible construction at costs that represent real savings. This, plus our unique distribution system, offers you a dependable, efficient source of supply for your reels.

Reels are furnished knocked down or assembled. Standard sizes in stock, special reels made to your specifications on short notice.

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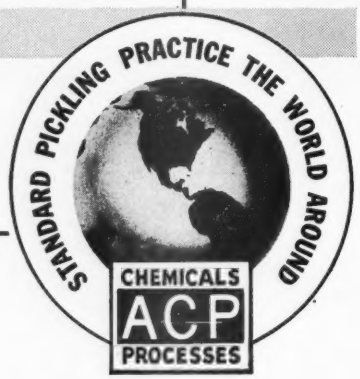
THIS IS THE TIME TO

SAVE PICKLING ACID!



Here are some ways to pickle more steel with less acid:

1. IMPROVE THE EFFICIENCY OF YOUR PRACTICE

Use every available pound of acid before dumping, by:

a. **Operating baths until more than the usual amount of iron accumulates,**
b. **Stopping the additions of acid sooner than usual,**
c. **Offsetting the slower pickling by raising bath temperature to boiling,**
d. **Lengthening pickling time for last one or two batches.**

Do not, if possible, dump bath with as much acid content as previously. Dump only when bath fails to work after above recommendations have been followed.

2. IMPROVE THE CHEMICAL EFFICIENCY OF YOUR PICKLING

Utilize every available pound of acid before dumping, by:

a. **Increasing the proportion of "RODINE"® in the bath up to 1% by volume of the acid.**

The increased amount of "RODINE" will:

a. **Save the acid now needlessly wasted dissolving good metal,**
b. **Retard from build-up, thus saving acid by reducing number of times tanks must be dumped.**

Write for further information on saving pickling acids.

Pioneering Research and Development Since 1914

AMERICAN CHEMICAL PAINT COMPANY

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Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

tion which specializes in making carbide tools for all makes of spring manufacturing machines. Complete details will be furnished on request by the Lundahl Corporation, 1425 Park Street, Hartford 6, Conn.

★ ★ ★

New Super-Fine Glass Fibers Announced

Production of the finest glass fibers ever made by man, was announced recently by **R. H. Barnard,** president of **Glass Fibers, Inc.,** Toledo, Ohio.

★ ★ ★

Diameters of the fibers produced by the Ohio concern are less than the shortest wave length of visible light. They are three times finer than any glass fibers previously manufactured on a commercial basis. A single pound of the fibers, laid end-to-end, would extend more than ten million miles.

★ ★ ★

In making his announcement, of this production achievement, Mr. Barnard added that his company had just completed a sizeable contract-order with the Navy for these fibers and that the material had been made by a patented process exclusive with his company.

★ ★ ★

Indicated uses for this amazing new material are myriad. The glass paper also appears to have widespread use in electrical equipment. Impregnated with suitable resins, it will find use as insulating tape for wire and cable and other applications in motors, generators and transformers.

★ ★ ★

Designers of power-type capacitors and condensers for electronic equipment and television and radio receivers will find new uses for this glass material. Capacitors and condensers made with thin glass paper will have lower electrical losses, greater high temperature stability and greater capacity per unit of weight and size than those made with present-day materials.

★ ★ ★

Although all current production of these infinitesimally-tiny fibers is now going to the armed forces and even small quantities are not now available for commercial laboratory experimentation, expectation is that the material will be commercially available to industry by late fall or the first part of 1952.

International Nickel Announces New Heat-Resistant Alloy

In line with the company's policy of conserving nickel supplies as far as possible during the current period of emergency, **The International Nickel Company** has announced the development of an alloy for use under conditions of high temperature and corrosion.

★ ★ ★

The new alloy, trade-named "Incoloy", contains about 35 percent nickel and 20 percent chromium, with the balance iron. It is produced in most standard rolling mill forms, including sheet, strip, rod, wire and tubing. This alloy is designed for many purposes now served by some of the company's older alloys, which run up to more than 70 percent nickel.

★ ★ ★

"Galvanizing (Hot-Dip)"

A new, third edition of "Galvanizing (Hot-Dip)" by **Heinz Bablik,** emphasizing practical and theoretical aspects of the subject, was published in June by John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y.

★ ★ ★

Dr. Bablik, owner-manager of his own galvanizing plant and lecturer at the Technical University of Vienna, presents an exhaustive survey of hot-dip galvanizing, the metallic rust prevention process in widest use. He discusses the structure and composition of the scale that occurs as a result of surface oxidation and covers the pickling theory and practice for scale removal, including a discussion of hydrogen inclusions resulting from pickling. After describing the nature and use of fluxes, Dr. Bablik devotes the major portion of his book to galvanizing theory and practice.

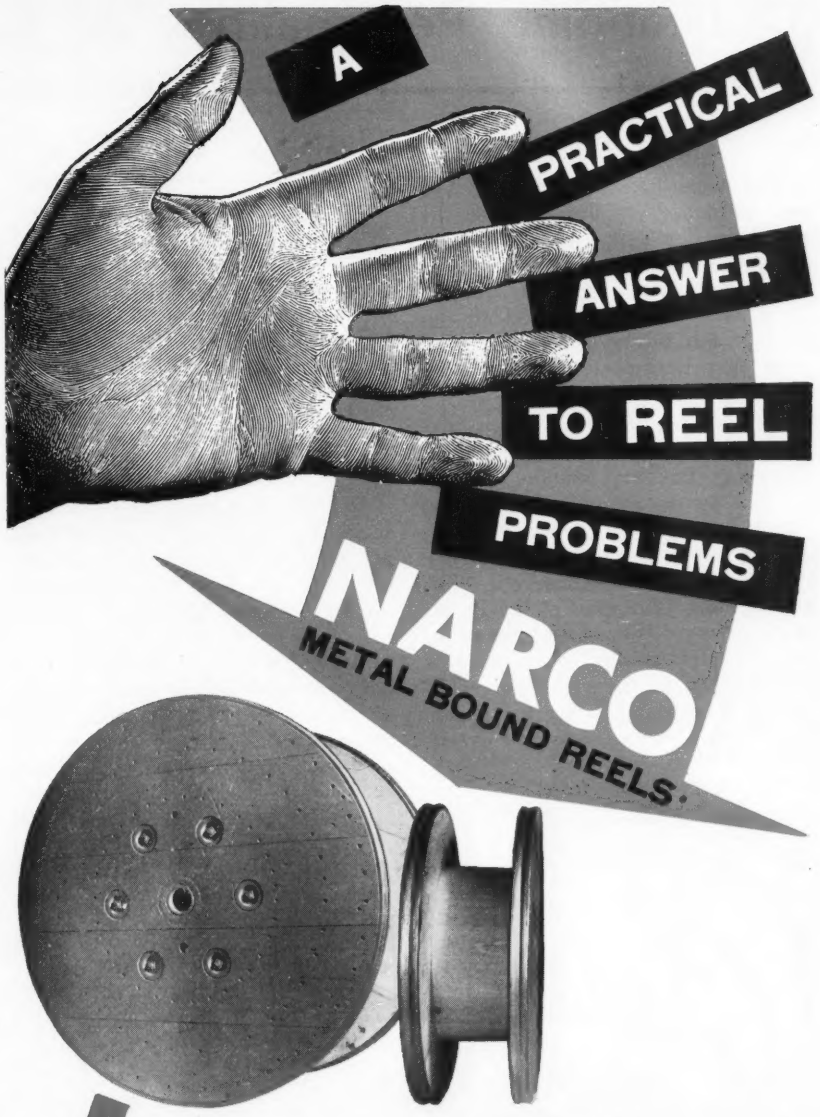
★ ★ ★

Completely revised and re-illustrated, the new edition includes the latest methods and processes. The author has extended his discussions of iron-zinc reaction and fusion-reaction and included illustrations showing the structure of the scale and zinc layers.

★ ★ ★

The third edition of this excellent treatise contains 502 pages and is priced at $10.00.

★ ★ ★



Such reels, of **NARCO** construction, combine **ECONOMY** with **SERVICE.**

They'll give three times as many trips and require no repairs. They cost only an average of 50% more per reel, yet cut your reel bills up to 300%.

Yes, we also build all-wood reels—any size from 12″ in diameter up. Metal Bound Reels made in 12″ through 48″ diameters.

Reels are furnished assembled or knocked down, as you prefer. Reel heads for steel drums.

If you are economy-minded and quality-conscious, you will want NARCO METAL BOUND REELS.

May we quote you on your REEL REQUIREMENTS?

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Outstanding Personalities of the Wire Industry

Charles B. Fantone

The wire industry was shocked and saddened by the news of the untimely death of **Charles B. Fantone,** President of the **Syncro Machine Company** of Perth Amboy, New Jersey. He died suddenly on August 6th while in Chicago, Illinois, on a business trip.

★ ★ ★

Mr. Fantone was Chairman of the Board of the Elevator Supplies Company, Inc., and was the founder of the Syncro Machine Company, which succeeded the Elevator Supplies Company in the manufacture of wire and cable machinery in 1937. He was also Chairman of the Board of the Syncro-Winget Company, an export affiliate. Mr. Fantone was well known in the wire and cable industry both in the United States and Europe, having traveled extensively in both countries.

★ ★ ★

Charlie will be greatly missed both by his associates and his many friends. A man of great energy, it was often said that he did the work of four men. He was an active member of the Wire Association and will be very much missed at the meetings. The officers and directors of the Wire Association extend their deep sympathy to his former associates and his family.

★ ★ ★

Joins Lee Wilson

John P. Zur, for many years associated with The Trauwood Engineering Company, has become affiliated with the **Lee Wilson Contracting Company** of Cleveland, Ohio.

★ ★ ★

Mr. Zur is well known in the wire industry and has been the author of several papers on annealing, tempering and patenting that have been published in Wire and Wire Products.

Industrial Ovens Appoints George H. Goecke Sales Engineer

The appointment of **George H. Goecke** as sales engineer for **Industrial Ovens, Inc.,** effective August 1st, has been announced by **C. A. Litzler,** Industrial Ovens' president.

★ ★ ★

Mr. Goecke will work under the direction of **J. K. Gillett,** sales manager, and will use the Cleveland headquarters of the Company at 13825 Triskett Rd., as his base of operations. Industrial Ovens designs and builds continuous processing equipment for the rubber, plastic, textile, paper and wire industries.

★ ★ ★

A graduate in mechanical engineering from Cornell University, Mr. Goecke was for fifteen years a sales engineer for the Ingersoll-Rand Company, in its Cleveland, Seattle and Boston offices successively. For the last year he has been a

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GLADER NAIL MACHINES
55 YEARS of experience meeting the exacting demands of nail making.
The machine with a record of steady dependable service.
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manufacturer's representative in northern Ohio and western Pennsylvania for the Warren Steam Pump Company of Warren, Mass.

★ ★ ★

During World War II Mr. Goecke, a native of Elyria, Ohio, was for two years in the U. S. Navy, in charge of torpedo overhaul shops and later as executive officer of an overseas air base in the Pacific theatre. He is married, has one child and has his home at 1785 East 236th St., Euclid, Ohio.

★ ★ ★

A.S.&W. Establishes Priorities Post

Appointment of **Raymond H. Armour** to the newly created post of operating priorities representative in the **American Steel & Wire Company's** production planning department has been announced by **L. W. Hackley, superintendent** of the **production planning department** of this U. S. Steel subsidiary.

★ ★ ★

Mr. Armour is a veteran of Wire Company service. He started with the company's plant in Farrell, Pennsylvania, in 1918 as an assistant shipping clerk. He held a number of assignments at the company's Consolidated Works and Newburgh Wire Works in Cleveland. In 1942 he was named schedule clerk in the production planning department of the Newburgh Wire Works and three years later was appointed supervisor of production planning at American Steel & Wire's American Works in Cleveland.

★ ★ ★

Made Works Superintendent of Donora Zinc Works

Howard E. Hornickel, who started his **American Steel & Wire Company** career as a blast furnace laborer during his summer vacations while attending Carnegie Institute of Technology, has been made works superintendent of the company's Donora Zinc Works at Donora, Pennsylvania.

★ ★ ★

L. F. McGlincy, Pittsburgh district manager of operations for this U. S. Steel subsidiary, announced Mr. Hornickel's appointment to succeed M. M. Neale, who has been associated with the Donora Zinc Works since its establishment in 1915 and has been works superintendent since 1946. Mr. Neale retired on July 31.

★ ★ ★

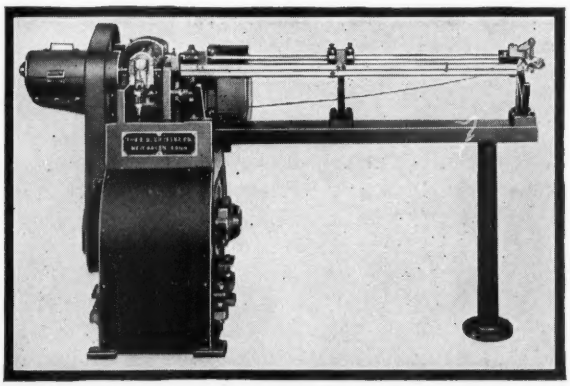
Mr. Hornickel is a native of Poland Ohio. Following two years at Colorado School of Mines in Golden, Colorado, he transferred to Carnegie Institute of Technology from which he was graduated in 1920 with a degree in metallurgy. Following his graduation, he started at the Steel Works as a chemist and two years later became assistant head chemist of the plant. In 1923 he was transferred to Cleveland as an assistant in the general superintendent's office and subsequently served ten years in the metallurgical department of the company in Cleveland. In 1936 he returned to Donora as chemist at the Donora Zinc Works and five years later was appointed works metallurgist. In 1948 he was named assistant works superintendent.

★ ★ ★

Keystone S&W Appointment

Ruben A. Redard has been appointed purchasing agent of the **Keystone Steel & Wire Co.,** Peoria,

Naturally...it's a "SHUSTER"–



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the only machine with a capacity from .025 to 1/16" diameter wire.

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Wire Netting Machines for Chain Link, Hexagonal Mesh, Poultry Netting, Field Fence. Crimping, Barb Wire and Staple Machines. Spring Coilers. Spring End Grinding Automatics. Loop Benders. Upholstery Spring and Wire Mattress Machines. Wire Nail Machinery. Chain Formers. Chain Welders. Straightening and Cutting Machines. Multi-Slide Wire and Strip Forming Machines. Special Machinery for the making of Paper Clips, Lock Washers, Bale Ties, Key Rings, Tin Openers, Wire Bag Ties, etc. Automatics for Flexible Metallic Tubing.

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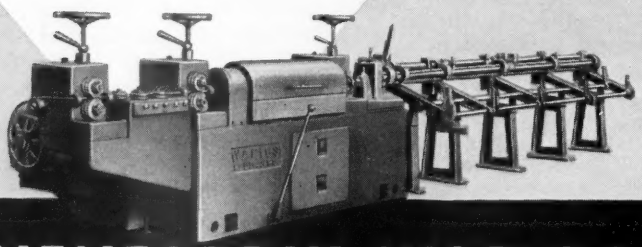
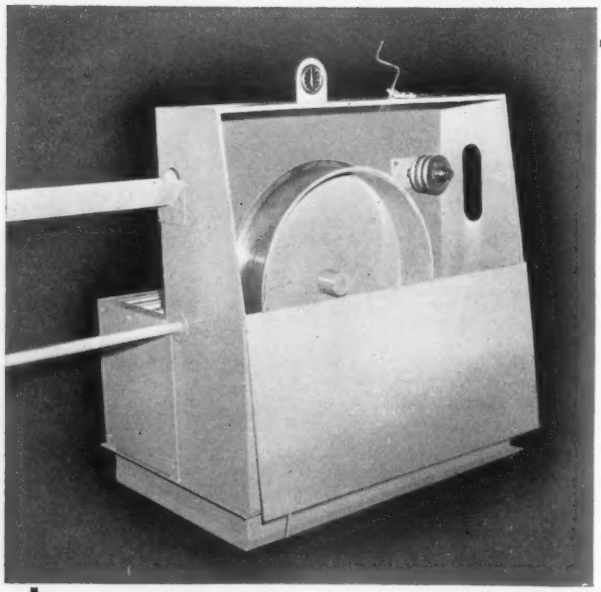


MASCHINENFABRIK WAFIOS

WAGNER, FICKER & SCHMID **REUTLINGEN 3 / WÜRTT. GERMANY**



50 MILLION FEET OF WIRE RUN ON FEDERAL CAPSTANS FOR SIX MONTHS PERIOD WITHOUT A BREAKDOWN.

These machines are equipped with variable torque controls. They are new in design, so engineered and built as to be the *most efficient take-up machines on the market.*

Have wide range of speeds—up to 2500 ft. per min. Heavy, rugged steel construction gives long life and smooth dependable service.

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Use FEDERAL —

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WIRE TWISTERS

Federal Manufacturing Co.

SPECIAL WIRE MACHINERY

236-240 Hall Avenue, Wallingford, Conn.

Ill., succeeding **Frank A. Little** who was promoted to director of purchases.

★ ★ ★

Riverside Metal Co. Appointment

Alfred G. Dennison was promoted from assistant sales manager to general sales manager of **Riverside Metal Co.**, Riverside, N. J., replacing **Fred M. Shelley Jr.** who will return to his former post as district manager of Newark, N. J., territory.

★ ★ ★

Carpenter Steel Co. Appointments

George V. Luerssen, chief metallurgist, was appointed vice president in charge of metallurgy by **Carpenter Steel Co.**, Reading, Pa. He succeeds **B. H. DeLong**, who retires as vice president and technical director after 41 years' service. **Carl B. Post** becomes chief metallurgist, and **George E. Brumbach** was promoted to metallurgist, succeeding Mr. Post.

★ ★ ★

David Larkin Retires

The many friends of **David Larkin** will join the officers of **Broderick & Bascom Rope Company** in wishing him Godspeed upon the occasion of his retirement.

★ ★ ★

Mr. Larkin relinquished his duties as Executive Vice-President on July 1st. Having reached retirement age, he contemplates enjoying a long-deferred period of leisure in which there will be opportunities for travel, writing and various personal pursuits.

★ ★ ★

Back in the early 1920's, as a consulting engineer, Mr. Larkin designed and supervised construction of B & B's large St. Louis factory. He joined the company in 1928 and has been instrumental in keeping their facilities and engineering services in step with the constant expansion of industry. The wire rope industry, as well as his former associates will miss his dynamic and constructive personality.

★ ★ ★

William F. Detwiler

Word has been received of the death on June 21st of **William F. Detwiler, Jr.**, assistant treasurer and director of the Central Cable Corporation.

Mr. Detwiler was 38 years old. He had been with the company since its establishment in 1939 except for a short interval before and during the war.

★ ★ ★

He was a graduate of Cornell University, and served in World War II as 1st Lieutenant in the Ordnance Corp from May 1942 until November, 1945.

★ ★ ★

Columbia Steel & Shafting Co. Appointments

Clark A. Sutton was appointed plant manager, **Columbia Steel & Shafting Co.**, Pittsburgh. **J. Ross Maxwell** was made superintendent of the bar mill, and **Malcolm C. Hulse**, superintendent of the tubing mill.

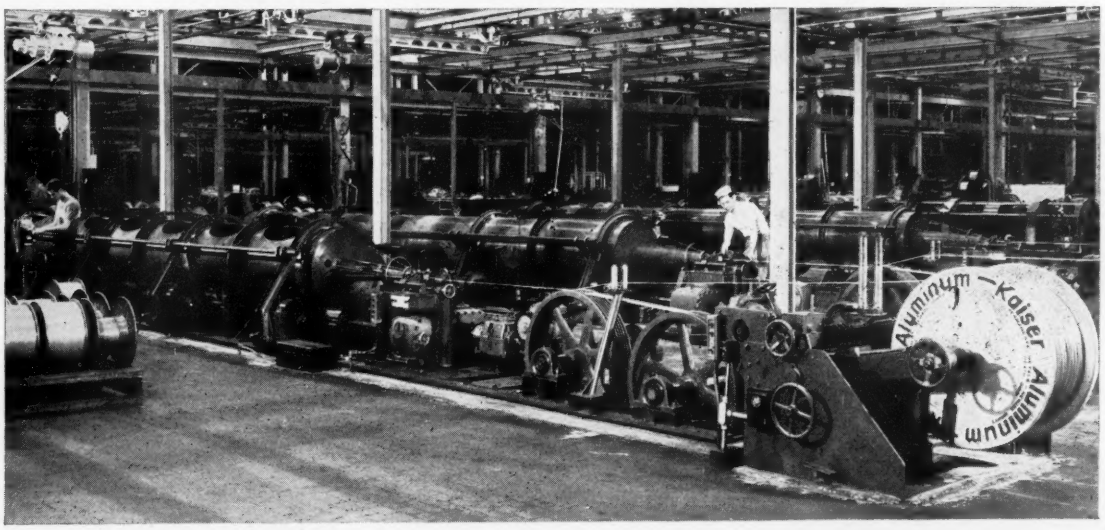
★ ★ ★

J. W. Gething Appointment

John W. Gething was elected vice president, **Laclede Steel Co.**, with headquarters in the Arcade building, St. Louis. Associated with the company 35 years, he served as general superintendent for the last ten years.

NEW 22" SPOOL 750 RPM TUBULAR STRANDER

HYDRAULIC LIFT REEL STAND — INFINITELY VARIABLE TRAVERSE AIR CONTROLLED
DOUBLE DRUM HAUL-OFF WITH LINK BELT P.I.V. — AIR OPERATED BRAKING SYSTEM



HMT — Hughesville Machine & Tool Company — Established 1846 — Wire & Process Machinery

Hi-Efficiency

HUGHESVILLE MACHINE & TOOL CO.
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HUGHESVILLE, PA.
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Lindberg Makes Appointments

Lindberg Steel Treating Company, Chicago, has made the following new appointments at the Chicago plant: **E. J. Pavesic,** ASM,—Director of Research, **N. O. Kates,** ASM,—Works Metallurgist, and **F. J. Minch,** ASM,—Metallurgist.

★ ★ ★

In addition to the above, **L. A. Lindberg,** president, announces that the following have been elected members of the Board of Directors: **A. E. Uitti,** Works Manager, and **K. U. Jenks,** Controller and Secretary.

★ ★ ★

Metal Carbides Opens Office in Detroit

The Metal Carbides Corporation, Youngstown, Ohio, announces the opening of a new sales office, warehouse and service plant at **20485 Van Dyke, Detroit, Michigan.** Located in a new concrete block building 20′ x 60′, a complete stock of standard Talide Carbide Products will be carried, including cutting tools, tips, centerless grinder blades, lathe centers, drill jig bushings and solid carbide strips, rods, tubes and bar stock, with **A. B. Christman** in charge.

★ ★ ★

Kadlic Named Philadelphia District Sales Manager by Roebling

The appointment of **John P. Kadlic** as Philadelphia district sales manager for the wire rope division of **John A. Roebling's Sons Company** has been announced by **E. C. Low,** vice president sales. Mr. Kadlic replaced **Vincent L. Daulton,** who lost his life in a recent train wreck.

★ ★ ★

A native of Bellair, Ohio, Mr. Kadlic is a 1935 graduate of Princeton University. Upon completion of his navy service, he joined the Roebling sales staff. Prior to assuming his new duties, Mr. Kadlic was the Company's sales representative in the St. Louis area.

★ ★ ★

Reeves to Build Plant on West Coast

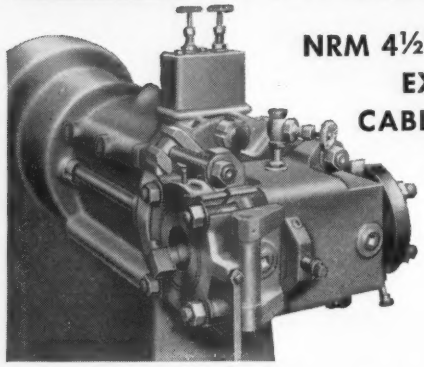
Reeves Pulley Company, Columbus, Indiana, manufacturers of REEVES Variable Speed Control Equipment, announce the expansion of their facilities on the West Coast by the establishment of an assembly plant, together with sales and engineering offices, in San Francisco, and the opening of a sales and engineering office in Los Angeles. These new facilities will enable customers to obtain faster delivery of REEVES Variable Speed Drives and repair parts.

★ ★ ★

R. G. Sullivan will be in charge of West Coast operations for REEVES. Mr. Sullivan, a registered professional engineer in California, has been active in West Coast engineering and manufacturing for several years. He is well acquainted with the REEVES Variable Speed Drives, since he was in charge of REEVES sales for several years while associated with Western Gear Works, who have represented REEVES on the West Coast for many years. Western Gear Works will continue to represent REEVES, making use of the new facilities.

Speed Production with

NRM WIRE & CABLE COVERING EQUIPMENT

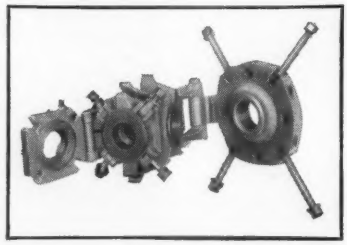


NRM 4½" HEAVY DUTY EXTRUDER WITH CABLE INSULATING CROSSHEAD

SCREW—High tensile alloy steel with surface hardened flights.
CYLINDER—Semi-steel with circulating water jackets and wear-resistant liners.
HEAD—Cast steel, jacketed, with standard or special threads.
BEARINGS—Oversized, heavy-duty, anti-friction roller and thrust bearings.
GEARS—Rugged, heat-treated, cut-steel herringbone type.
FEED BOX—Undercut for hand or mechanical strip feeding.

NRM QUICK-OPENING CROSSHEADS

- Steam, oil or electrically heated.
- Quick opening for screen and die changing.
- Adjustable tips and dies.
- Controllable die heat.



Send for information on NRM's complete line of cable and wire covering equipment

NATIONAL RUBBER MACHINERY CO. General Offices & Engineering Laboratories Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
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Creative Engineering

PRICE REDUCTION!

Because of greatly reduced selling cost, we are able to reduce the price of Magnus Wire Coating Compound #267 by 2¢ per pound. The new price is 10 9/10¢ per pound, F.O.B., Garwood, N. J.

MAGNUS
CHEMICAL CO., INC. Garwood, N. J.

A Review of Recent Wire Patents

No. 2,558,874, MACHINE FOR MAKING PACKING CASES, patented July 3, 1951 by Robert A. Muller, New London, N. H., assignor to Atlas Plywood Corporation, Boston, Mass., a corporation of Massachusetts.

More specifically, this patent covers a wire stitching machine for securing together a number of panels and connecting strips to provide a collapsible packing case. There are 31 claims.

★ ★ ★

No. 2,558,910, GARMENT HANGER, patented July 3, 1951 by John David Peacock, Sr., Westville, N. J.

The hanger is constructed of a single length of wire.

★ ★ ★

No. 2,558,929, RUBBER INSULATED POWER CABLE, patented July 3, 1951 by Stephen Bunish and Herbert C. Witthoft, Marion, Ind., assignors to Anaconda Wire and Cable Company, a corporation of Delaware.

Filling the interstices between the rubber-sheathed wire conductors, is a rubber composition filler which contains 5% to 20% by weight of graphite, has an electrical resistivity at 75°F. of at least 4×10^6 ohms per cubic centimeter and possesses sufficiently good thermal conductivity that the mid-point of the upper surface of a layer thereof 6 inches in diameter and three-fourths of an inch thick, originally at a temperature of 77°F. will reach a temperature of 160°F. at least within 25 minutes when the layer is placed on a hotplate maintained at 280°F.

★ ★ ★

No. 2,559,139, WIRE CLOTHESPIN, patented July 3, 1951 by William Wheeler, Coventry England.

This pin is formed of one length of wire, bent to shape.

★ ★ ★

No. 2,559,642, RIBBON CABLE, patented July 10, 1951 by Jakob Kruithof and Marinus Jochem, Antwerp, Belgium, assignors to International Standard Electric Corporation, New York, N. Y., a corporation of Delaware.

The cable comprises a number of coplanar parallel wires arranged in two laterally spaced groups, one group being in each half of the cable with insulation around and along the wires maintaining them in this relationship. The insulation is slotted to enable the wires to be severed at the slots without mutilating the insulation.

★ ★ ★

No. 2,559,732, AIRPLANE ANCHOR SCREW KIT, patented July 10, 1951 by Wright J. Padgett, Wichita, Kans.

A kit is provided composed of a number of separate helical anchoring members, each having spaced coils terminating at one end in an eye, two of the members being coaxially nested together with the eyes thereof in side to side relation and another of the members being turned reversely with the coils turned within the nested members to retain the members in coaxial compact assembly.

★ ★ ★

No. 2,559,824, METHOD OF WINDING LAYER WOUND MAGNET COILS, patented July 10, 1951 by George H. Leland, Dayton, Ohio.

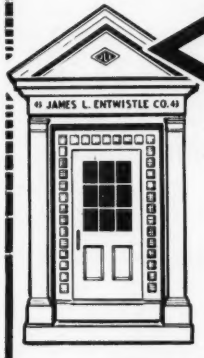
Here the method comprises winding in each layer multiple wires in part turn increments, each increment being in a plane perpendicular to the axis of the coil, and shifting each succeeding part turn in each wire in each layer in the same direction lengthwise of the axis of the coil with relation to the next preceding part turn in the layer, the several shifts in each wire in each layer being of a combined axial length slightly greater than the combined diameters of the multiple wires.

★ ★ ★

No. 2,560,189, COIL FORMING PRESS, patented July 10, 1951 by Worley Grant Royston, Logan, W. Va.

The assembly comprises a body having an inclined surface, a forming head having an inclined surface parallel to the first surface, a spring-biased plate on the body at right angles to the inclined surface thereon, a spring-biased plate on the forming head at right angles to the inclined surface thereon, and a device for simultaneously moving the inclined surfaces and the slidable plates toward each

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.



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SERVING THE WIRE INDUSTRY THROUGHOUT THE WORLD

- Standard Sets of Spark-Testing Equipment
- Take-ups and Re-spoolers
- Reelers
- Coilers
- Spoolers
- Collapsible Coiling Reels
- Wire Sparkers and Accessories
- Hand Locators
- Electrode Units and Stands
- Measuring Machines, Counters and Accessories
- Wire Guide Units
- Pay-off Reels Stands
- Electronic Devices
- Conduit Connection Sets
- Wire Pre-Heater
- Disk Brakes and Controls, Drag Units and Slip Clutches
- Wire Marking Machines, Type Strips, Inks
- Labelling Machines
- Pneumatic Equipment and Controls
- Miscellaneous Equipment
- Hydraulic Equipment and Controls
- Hi-Pot Test Sets
- Cable Handling Equipment for Warehouse Use

See page 750 for news of the New Automatic Dual Take-Up

JAMES L. ENTWISTLE CO.

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European & South American Agents:
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British Associate:
GENERAL ENGINEERING CO., LTD.
BURY ROAD, RADCLIFFE, LANCASTER, ENGLAND

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other, thereby constricting the space between the inclined surfaces and the slidable plates.

★ ★ ★

No. 2,560,202, RUST INHIBITING COMPOSITION, patented July 10, 1951 by John C. Zimmer, Union, Gordon W. Duncan, Westfield, and Charles E. Paxton, Jamesburg, N. J., assignors to Standard Oil Development Company, a corporation of Delaware.

This composition consists of a mineral base oil of lubricating grade containing 0.5 to 3%, based on the total composition, of a mono-oleic ester of pentaemythritol, 0.5 to 3% of an oil soluble petroleum sodium or calcium sulphonate.

★ ★ ★

No. 2,560,204, AUTOMATIC STRAND FEED REGULATOR, patented July 10, 1951 by Karl H. Andren, Milwaukee, Wis., assignor to Artos Engineering Company, Milwaukee, Wis., a corporation of Wisconsin.

Strand tensioners are provided, including upper and lower movable slides for defining the upward movement of the strand-guiding sheaves and the slides being limited in their downward movement.

★ ★ ★

No. 2,560,643, NAIL WITH SPREADING POINTS, patented July 17, 1951 by Robert Lay Hallock, Larchmont, N. Y., assignor to Elastic Stop Nut Corporation of America, Union Township, N. J., a corporation of New Jersey.

A nail with bifurcated points is disclosed for securing a first body of relatively hard material having a preformed aperture therein to a second body of relatively softer material.

★ ★ ★

No. 2,560,699, SOAP HOLDER, patented July 17, 1951, by Isidore Morse, Bronx, N. Y.

This holder comprises a single length of wire, bent to shape.

★ ★ ★

No. 2,560,794, WIREWORKING MACHINE patented July 17, 1951 by Emil Gut, Luzern, Switzerland.

The machine is for forming heads on pins or rivets in one of several swaging operations.

★ ★ ★

No. 2,560,842, WIRE SPRING STRUCTURE FOR SEAT CONSTRUCTIONS, patented July 17, 1951 by Svend G. Blumensaadt, Beachwood Village and William H. Neely and Norman A. Page, Cleveland, Ohio, assignors to Universal Wire Spring Company, Cleveland, Ohio, a corporation of Ohio.

A wire spring construction is disclosed, embodying a number of sinuously corrugated, M-shaped wire springs having parallel top and bottom portions lying in horizontal planes when the construction is assembled.

★ ★ ★

No. 2,561,045, CLOTHES HANGER, patented July 17, 1951 by Benjamin Belefant, Bronx, N. Y., assignor of one-half to Carl E. Carlsen, New York, N. Y.

The wire of the hanger is of one piece and bent to form two parallel supports for the clothes.

★ ★ ★

No. 2,561,562, ARMATURE WINDING MACHINE, patented July 24, 1951 by Edward W. Collins, Anderson, Ind., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware.

A machine is provided for winding wires into slots of armature cores assembled with shafts comprising a fixed wire placer having a number of shoes arranged in a circular row and adapted to be received by a core slot and having a passage receiving wires from supply spools.

★ ★ ★

No. 2,561,736, APPARATUS FOR COILING FILAMENTS, patented July 24, 1951 by Estyle D. Hanson, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

A dual-purpose apparatus for coiling filaments is provided and comprises a pair of takeup reels, means for driving the takeup reels, for an actuator for simultaneously starting one of the reel-driving devices and stopping the other, a guard movable between a position in front of one of the takeup reels to a position in front of the other, and means operable by the guard to operate the actuator when the guard is moved from a position in front of one of the reels to a position in front of the other.

★ ★ ★

No. 2,562,075, APPARATUS FOR DETERMINING THE AVERAGE THICKNESS OF COILED STRIP, patented July 24, 1951 by Patrick H. Washam, Jr., Girard, Ohio.

More specifically the apparatus for determining the average thickness of strip while being coiled on a reel.

★ ★ ★

No. 2,562,099, SPRING ASSEMBLY, patented July 24, 1951 by John Hilton, Dublin, Eire.

An upholstery spring assembly is provided including coil springs concentrically arranged, one within another; the outer spring of each unit being shorter than the inner spring so that said outer

No More Liming Hazards in Bar and Rod Drawing!

HOUGHTO-DRAW

DRY FILM DRAWING COMPOUND

. . . won't rupture under extreme pressures

. . . provides "controlled friction" lubrication

. . . permits faster, "chatter-free" drawing

. . . prevents "welding" of die and work

The fast-growing number of Houghto-Draw users are finding it superior in many ways as a replacement for lime coating.

Houghto-Draw dry film drawing compound is cleaner and easier to handle in preparing hot or cold rolled bars for cold drawing. It keeps the surface of bars smooth and the finish brighter. It requires only one immersion. And much less time and heat are needed to bring the Houghto-Draw solution to proper working temperature. Its thin film (approximately .001") is easily removed.

Houghto-Draw underwent extensive testing in actual production before it was offered to industry a year ago. Ample performance records are available to show you how it can improve your bar quality and output. For further information, write E. F. Houghton & Co., Philadelphia 33, Pa.

Why not let the Houghton man arrange a test run in your mill to prove Houghto-Draw's advantages to you? Meantime, write for information.

HOUGHTO-DRAW
... a product of
E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

spring only comes into action when the inner spring has been partially compressed.

★ ★ ★

No. 2,562,340, WEIGHT-GRADUATED WIRE CABLE, patented July 31, 1951 by Robert L. Stanton, Muncy, Pa., assignor to Jones & Laughlin Steel Corporation, Pittsburgh, Pa., a corporation of Pennsylvania.

A cable is disclosed, composed of continuous wires, including a number of composite wires formed of steel at one end and a metal lighter than steel at the other, the junctions between steel and lighter metal in the composite wires being staggered over the length of the cable.

★ ★ ★

No. 2,562,500, INK DEVICE FOR MARKING THE SURFACE OF ELECTRICAL CONDUCTORS, patented July 31, 1951 by Alden P. Lunt, Theodore R. Norton, and Carl P. Anderson, Ansonia, Conn., assignors to Noma Electric Corporation, New York, N. Y., a corporation of New York.

The machine will mark the surface of the insulation upon drawing it therethrough.

★ ★ ★

No. 2,588,993, APPARATUS FOR APPLYING VISCOUS COATING COMPOSITIONS TO WIRE, patented July 8, 1951 by Howard W. Sturgis and Emil H. Olson, Muskegon, Mich., assignors to Anaconda Wire and Cable Company, a corporation of Delaware.

Associated with a wire-carrying, freely rotatable wheel, partly immersed in the coating composition is a wiper element having a cylindrically curved face of approximately the same radius of curvature as the rotatable wheel bearing against the cylindrical face of this wheel about at the point where the wire emerges from the coating composition, the wiper element being restrained from rotation about the center of curvature of its face, and the center of the wheel and the center of curvature of the face of the wiper element being horizontally aligned.

★ ★ ★

New Conveyor Chain Announced

A new flat top conveyor which flexes in two planes — both horizontally and vertically . . . and can curve around corners with a radius of as little as 6 inches with ease, is now being marketed by Chain Belt of Milwaukee under the name, Rex FlexTop.

★ ★ ★

A FlexTop conveyor can be driven from one power source (within limits of chain loading), eliminating the need for transmission parts at transfer points. This can result in considerable savings both in first and operation costs.

★ ★ ★

FlexTop consists of carbon or stainless steel crescent-shaped top plates mounted on links which are connected by a specially designed universal joint. Top plates are induction welded to the chain links. The chain operates over special cut-tooth sprockets. It operates around horizontal idler disks, 14 inches in diameter at corners. Two disks are used at each corner, one for the carrying strand and one for the returning strand. The speed at which the chain can be run is determined by the product being handled and by the length of the conveyor. For additional information, write **Chain Belt Company**, Dept. PR, 1600 West Bruce Street, Milwaukee 4, Wisconsin, and request a copy of Bulletin 51-60.

★ ★ ★

PRICE REDUCTION!

Because of greatly reduced selling cost, we are able to reduce the price of Magnus Wire Coating Compound #267 by 2¢ per pound. The new price is 10 9/10¢ per pound, F.O.B., Garwood, N. J.

MAGNUS

CHEMICAL CO., INC. Garwood, N. J.

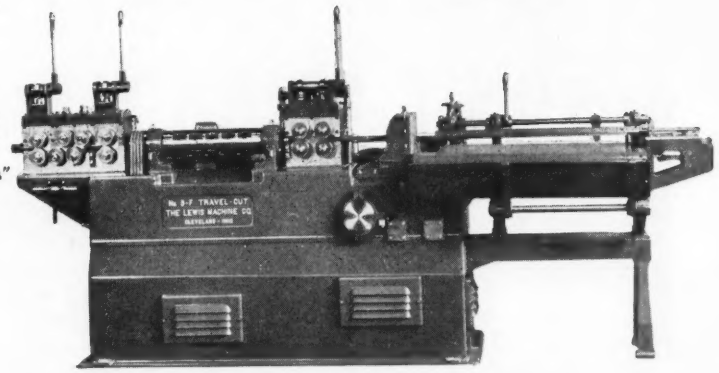
Fast, Accurate, Economical

STRAIGHTENING and CUTTING

with LEWIS **TRAVEL-CUT**

MACHINES

22 Models to handle from 1/16" to ¾" Round, Hex, Flat, Shapes.



Simple in design, rigid in construction, Lewis TRAVEL CUT will deliver continuous dependable service under the most severe, high production conditions—day in, day out. Feeds wire from the coil, straightens accurately, gauges to uniform length, and cuts clean without stopping the wire. For steel, brass, aluminum and alloy wire. Cut your cutting costs with the Lewis TRAVEL CUT. Full details on request.

Exclusive Representatives

EAST: Penn Machinery Co., 117 North Third Street, Philadelphia 6, Penn.

MIDDLE WEST: Steel & Wire Machinery Co., 15457 Euclid Ave., Cleveland 12, O.

CENTRAL: Moslo Machinery Co., 2443 Prospect Avenue, Cleveland 15, Ohio.

WEST COAST: Hoffman & Heartt, 3005 So. Grand Ave., Los Angeles 7, California

CANADIAN: Empire Engineering Co., 11 Wellington St. E., Toronto 1, Ontario.

CONTINENTAL EUROPE: Gaston E. Marbaix Ltd., Devonshire House Vicarage Crescent, London S. W. 11, England.

The LEWIS MACHINE Company

3441 E. 76th Street, Cleveland 27, Ohio

Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne

Filtration of Lubricating and Cooling Oil in Wire Drawing and Strip Rolling

(Continued from page 763)

products in the oil partly due to a breakdown of the oil under heat, and possibly inpart, due to pickling acid residues on the strip. The acid number of the oil as received from the manufacturer was .01 and within an operating period of two weeks an analysis indicated that the acid number had increased to 1.0. The oil in question is a so-called "spindle" oil having a viscosity of approximately 100 ssu at 100° F. There are no extreme pressure or other additives in the oil.

★ ★ ★

The first step was to set up a trial Hercules Filter on the system. This was precoated in the standard manner with Chrysolite and diatomaceous earth media. This was found to do an excellent job of filtration and accordingly a filter of adequate size was purchased and installed on a bypass system as described above. This filter installation is illustrated in figure four.

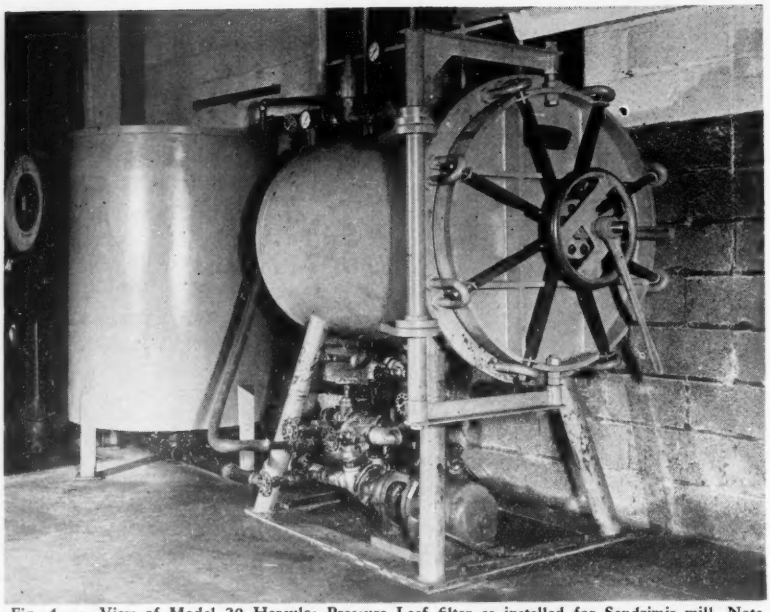


Fig. 4. — View of Model 20 Hercules Pressure Leaf filter as installed for Sendzimir mill. Note compactness of this arrangement as contrasted with Figure #2. Due to space considerations, this filter is outside of the partition wall housing the mill.

★ ★ ★

After installation of this machine, it was suggested that we attempt purification of the oil by the use of Brilliant Asbestos and Activated Carbon in place of Chrysolite and Diatomaceous earth. This experiment was highly successful and has resulted in our ability to hold the acid number to .01 throughout the filtering cycle of approximately 2 to 3 months. This installation has been in operation over a period of

the ROYLE SPIROD* EXTRUDER

A completely new and different concept of electrically heated extruder designed for plastics materials. . . . Higher operating temperatures. . . . Lower operating costs. . . . Radiant heated. . . . Zoned as required throughout cylinder and head. . . . Even and controlled cooling. Royle Spirod Extruders have been field-tested and their stamina proved. Check these features that assure trouble-free operation —positive results.

- Heavy steel members without flanges
- Spirally installed rod type heating elements provide faster and more even distribution of heat
- Radiant heat provides steadier temperatures
- Complete insulation reduces heat loss with substantial power savings
- High watt capacity heating elements provide faster heat at lower cost
- Long life heating elements provide high and sustained operating temperatures
- Separate heating zones controlled by proportioning instruments
- Simple installation should replacements become necessary

*Patent Applied For

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England — James Day (Machinery) Ltd. — REgent 2430

Home Office — V. M. Hovey, J. W. VanRiper — SHerwood 2-8262

Akron, Ohio — J. C. Clinefelter — JEfferson 3264

Los Angeles, Cal. — H. M. Royal, Inc. — LOgan 3261

PATERSON 3, NEW JERSEY

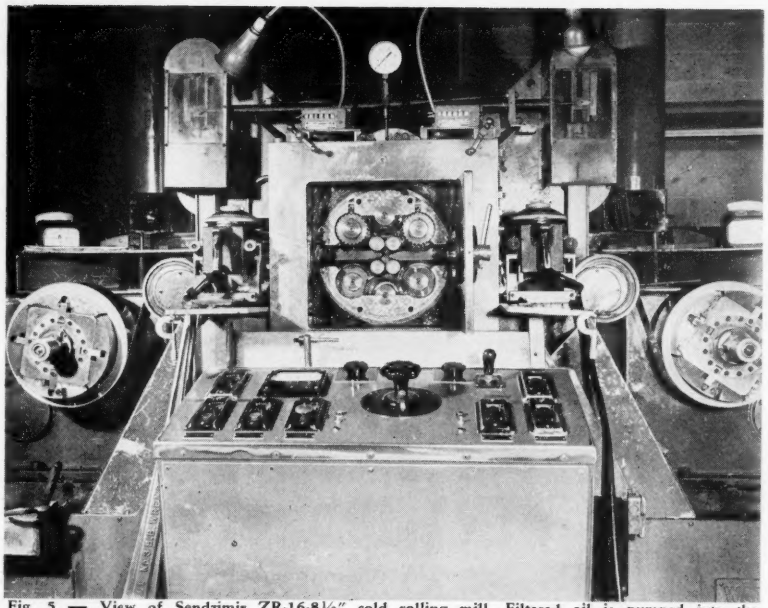


Fig. 5 — View of Sendzimir ZR-16-8½" cold rolling mill. Filtered oil is pumped into the housing (door shown open) and flows through the bearings and flood rolls and strip, thus acting as both lubricant and coolant.

more than a year, and, the color, viscosity and acid number of the original batch of oil has remained unchanged. Precoating cost is approximately $12.00 and requires two man hours per change.

★ ★ ★

This system is now becoming more widely recognized in the wire drawing and cold rolling fields due to its many advantages.

1. **Ease and economy of operation.**
2. **The bypass system eliminates the necessity for shutting down production equipment for servicing the filter.**
3. **The use of any one of a number filtering media enables purification and chemical treatment of oil as well as filtration.**
4. **The use of adequately filtered oil eliminates the need of frequent shutdowns of production equipment for cleaning and desludging.**
5. **The use of adequately filtered oil eliminates the possibility of clogging of oil passages which have often resulted in burned dies, scored bearings, etc.**

★ ★ ★

Experimental work is now being conducted on the filtration of soluble lubricants with some encouragement that this problem can be successfully met. The existing installations of this equipment are all in the alloy wire and strip industry, but it is believed that the system is equally applicable to any wire drawing or cold rolling installation where oil is used as a coolant or lubricant in the steel, copper, brass or aluminum industries.

★ ★ ★

MEYER, ROTH + PASTOR
MASCHINENFABRIK
KÖLN-RADERBERG
R+P
SINCE 1870
PRODUCTION PROGRAM FOR 1951
Machines for chain making:
Chain bending and welding machines for wire diameters of 2—26 mm. Bending and welding machines for crane and extra-heavy chains with a wire diameter up to 36 mm.
Chains twisting machines. Machines for manufacturing knotted chains. Chain calibrating, testing and stamping machines.
Machines for making chain fittings.
Welding machines for single chain links, rings, buckets, etc.
Wire and sheet metal working machines for the production of:
Wire nails, wire brads and cut tacks, roofing nails, bicycle spokes, lock washers, bottle caps, threaded studs, sleeves and bushings for bicycles, motorcycle and drive chains, core frames, can opener keys, rivets and bolts, rail spikes, shoe nails, heel plates, cotter pins, forked rivets, and many other wire and sheet metal articles.
Wire straightening and cutting tools.
Grinding machines for wire nail cutters.
Messrs. MEYER ROTH and PASTOR
MACHINENFABRIK
KÖLN—RADERBERG, GERMANY
Agents are wanted to represent us in the U.S.A. on a commission basis or for own account. Please write.

PRESENTLY *it is not only a need* **BUT A DUTY TO PRODUCE MORE AND MORE**

One way . . .

THE POURTIER insulating machine

Since 1860

HERE the speciality for magnet wire from 12 to 27

OUR STANDARD MACHINE No. 302

convenient for all kind of Insulating Material:

10 Heads of 1, 2, 3 decks.

High speed of 4,500 RPM, stop motion stopping each head in case of breakage equipped with our compensator serving bowl. Regulated traverse. Direction easy to change. Handling large drums.

and don't forget . . . our prices!

POURTIER MACHINES

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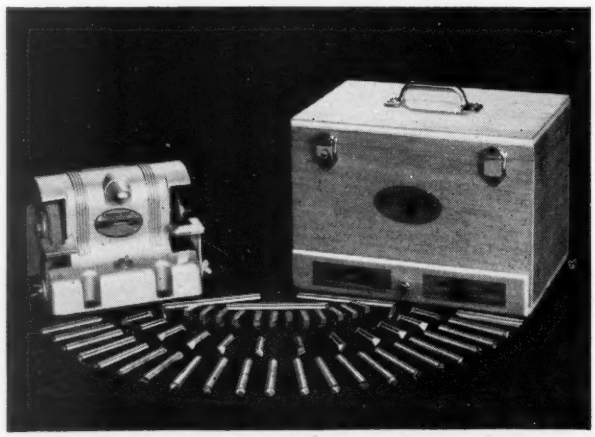
ROMAINVILLE - SEINE FRANCE

THE *Lundahl* SET-UP KIT

Saves Money on Tool Cost
Saves Machine Set-up Time
Assures Close Tool Control



The Lundahl Set-up Kit provides a complete set of carbide tools for a particular spring-making machine. Each tool is fitted in a marked cavity in the handsome case providing visual selection of any tool and giving close tool control.

The cabinet also contains a high-speed grinder fitted with one 4½" diamond wheel and one 4½" silicon-carbide grinding wheel.

Operator can set-up machine faster and the handy grinder permits touching up tools when needed.

Send for complete information on Lundahl Set-up Kits designed especially for your particular models of Sleeper & Hartley or Torrington Spring-Making Machines. Special kits available on request.

LUNDAHL CORPORATION, 1429 PARK STREET, HARTFORD 6, CONN.

Specialists in Tooling for Spring Makers

Inco Nickel Production Increased 1,000,000 Pounds Monthly

The 1,000,000 pounds monthly increase in the production of refined nickel by Inco, predicted by the end of this year at the company's annual meeting last April, has now been achieved, **Dr. John F. Thompson,** Chairman and President of The International Nickel Company of Canada, Limited, announced in July.

★ ★ ★

This increase in nickel production is a result of the major program of expansion of underground mining capacity, metallurgical process changes and the installation of emergency facilities at Inco's Canadian plants.

★ ★ ★

Through this augmentation, International Nickel's production will be at a capacity of 21,000,000 pounds per month—a higher level than in any peace-time year.

★ ★ ★

New Synthetic Cement for Tanks Announced

The Atlas Mineral Products Company, Mertztown, Penna. announces ALFANE, a light colored synthetic resin cement which, in addition to being resistant to most acids, salts, solvents and greases, has excellent resistance to all alkalies. Unlike other resin cements, ALFANE sets hard in contact with concrete and metals and exhibits outstanding adhesion properties for jointing brick and tile and adhering glass, concrete, metals and other materials. Bulletin 5-30D gives complete details on this new product.

★ ★ ★

Keystone Elects Officers

The Board of Directors of the **Keystone Steel & Wire Company** have elected **Walton B. Sommer,** Vice-President and **Paul W. Sommer,** Treasurer, according to an announcement made by Company officials.

★ ★ ★

Paul W. Sommer assumes his new duties recently with the retirement of W. O. Fritze, former Vice-President and Treasurer. Mr. Sommer has been a Vice-President since October 1, 1950.

★ ★ ★

Walton B. Sommers election to Vice-Presidency brings him the responsibility of Coordinator of Management Problems between Keystone and its subsidiaries. He has been Assistant to the President since March 1, 1951.

★ ★ ★

They represent the fourth generation of the Sommer family in the Keystone management. Their great grandfather and grandfather were co-founders of the firm in 1889.

★ ★ ★

Other appointments made by the Executive Committee of Keystone, as announced by Mr. R. E. Sommer, President and General Manager were—

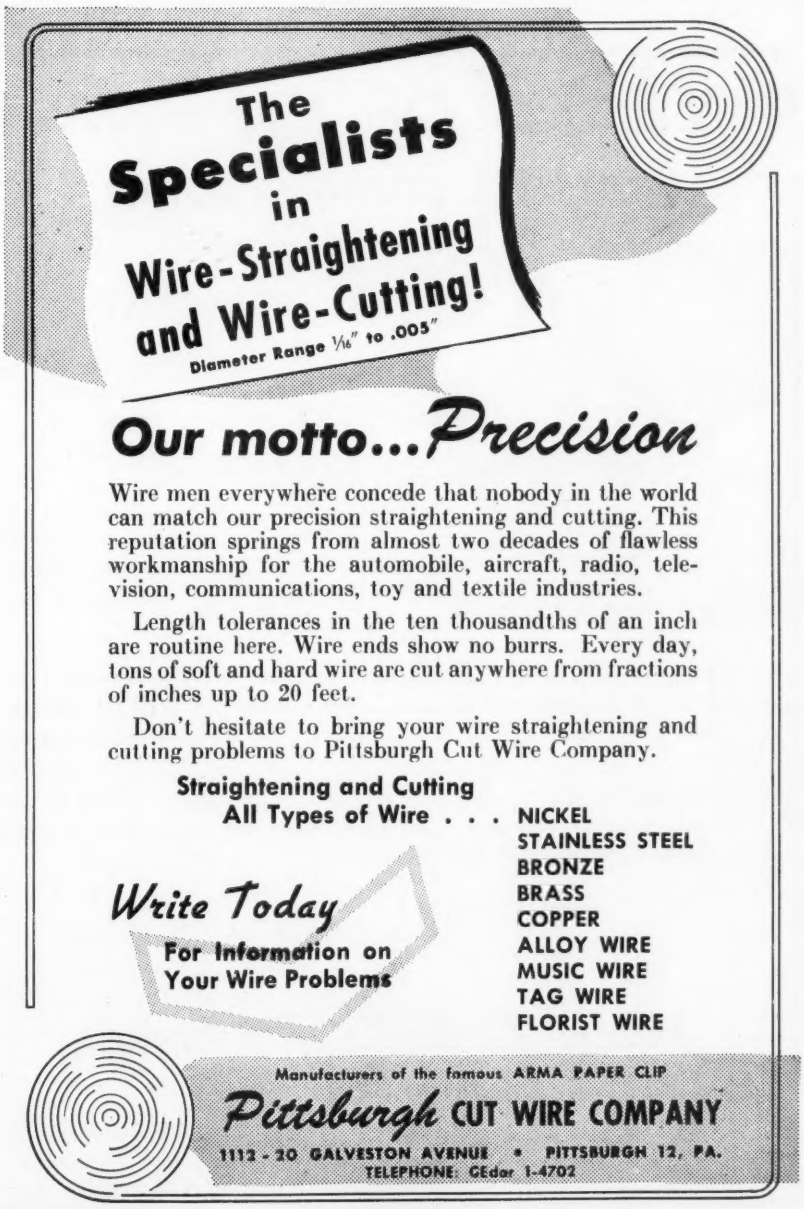
Frank A. Little, Director of Purchases succeeding Mr. W. C. Erkert, recently retired;

Ford P. Schusler, Sales Manager of the Industrial Division;

William H. Getz, Sales Manager of the Merchant Trade Division.

Ford P. Schusler and William H. Getz formerly were assistants to Walter H. Gardner who retired.

★ ★ ★


The
Specialists
in
Wire-Straightening
and Wire-Cutting!
Diameter Range 1/16" to .005"
Our motto...Precision
Wire men everywhere concede that nobody in the world can match our precision straightening and cutting. This reputation springs from almost two decades of flawless workmanship for the automobile, aircraft, radio, television, communications, toy and textile industries.
Length tolerances in the ten thousandths of an inch are routine here. Wire ends show no burrs. Every day, tons of soft and hard wire are cut anywhere from fractions of inches up to 20 feet.
Don't hesitate to bring your wire straightening and cutting problems to Pittsburgh Cut Wire Company.
Straightening and Cutting
All Types of Wire . . .
NICKEL
STAINLESS STEEL
BRONZE
BRASS
COPPER
ALLOY WIRE
MUSIC WIRE
TAG WIRE
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Write Today
For Information on
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Wickwire Spencer Advances Charles P. Harlow

Charles P. Harlow's appointment effective June 15, 1951 as sales manager of the **Hardware Products Department,** of the **Wickwire Spencer Steel Division** of **The Colorado Fuel and Iron Corporation,** was announced by **H. C. Allington,** General Sales Manager at the executive offices of the corporation at New York City.

★ ★ ★

In 1936 Mr. Harlow joined the then Wickwire Spencer Steel Company. Since that time, with the exception of four years service in the United States Coast Guard, he has served in various capacities in their Clinton and Worcester mills and in the New York and Boston district offices.

★ ★ ★

Mr. Harlow succeeds **William Sewert** who has resigned. Mr. Harlow and **William Kempton,** Assistant Hardware Products Sales Manager, will continue to be located in the new sales office of the Hardware Products department at the corporation's subsidiary, American Wire Fabrics Corporation, Mt. Wolf, Pennsylvania.

★ ★ ★

J. & L. Elects New Director

Dr. John C. Warner, president of Carnegie Institute of Technology, has been elected a director of **Jones & Laughlin Steel Corp.,** Pittsburgh, replacing **Walter H. Dupka,** who has retired.

★ ★ ★

New Surface Tension Depressant for Acid Solutions Developed

Nopco 1067-A, a new surface tension depressant, especially designed for use in mineral acid solutions, shows unusual promise for use in pickling, anodizing, wire treatment and similar metal-working operations.

★ ★ ★

Plant performance tests show striking benefits in saving of acid by increasing drain-off of pickling solution from metal work, and in reducing acid contamination in subsequent handling. Low surface tension values are maintained in cold and hot sulfuric and other acids in concentrations up to 25%. In certain processes where fuming occurs, the use of this new surfactant has made possible the elimination of expensive exhaust fan systems.

★ ★ ★

Technical literature describing the desirable effects of Nopco 1067-A in acid solutions is available. Write publication or manufacturer direct. Nopco Chemical Company, Harrison, New Jersey.

★ ★ ★

Issues 50th Anniversary Catalog

One of the oldest manufacturers of electric motors has issued a fine catalog in commemoration of this milestone in their history. This is the **Louis Allis Company,** Milwaukee 7, Wisconsin.

★ ★ ★

Besides depicting their current line of motors, the catalog presents much historical data on the early history of the company and shows pictures of some of their early products.

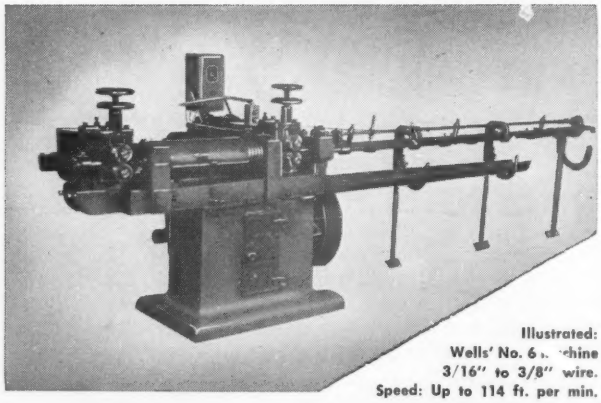
★ ★ ★

Copies of this handsome brochure are available to those interested in it.

★ ★ ★

9 YEARS OF STRAIGHTENING AND CUTTING

AND STILL GOING STRONG!



Illustrated: Wells' No. 6 ... chine 3/16" to 3/8" wire. Speed: Up to 114 ft. per min.

One user who has three makes likes WELLS' Machines because they've stood up under severest conditions, operating practically 24 hours a day for 9 long years.

This WELLS' customer has been cutting 3/8" hot rolled rods, with tolerances of ±1/8" at 120F.P.M. In spite of the scale, his WELLS straighteners and cutters have carried on uninterruptedly with great speed and accuracy.

WELLS machines will do the same for you. Will handle 1/16th to 5/8" stock. Backed up 57 years of experience, machines are rugged, dependable, precision made. *And low in cost!*

Get the facts. Send for catalog No. 50, describing these and other WELLS wire working machines. Address inquiries to:

Frank L. Wells Company

5821 FIFTH AVENUE

KENOSHA **WISCONSIN**

Builders of Wire Making Machinery

Elgin Offers Folder on New Diamond Abrasives for Carbides

Introducing a new diamond abrasive prepared especially for lapping and polishing carbide drawing and heading dies, the **Abrasive Division of The Elgin National Watch Company,** Elgin, Illinois offers a new four page folder on DYMO-C (C for carbide). The folder details the specific performance and application advantages of DYMO-C, said to be proved up to 20% faster than abrasives formerly used for finishing dies used in wire drawing and cold heading.

★ ★ ★

In addition to descriptive information, the folder contains complete catalog and price data. Copies are available on request addressed to Abrasives Division, Elgin National Watch Company, Elgin, Illinois.

★ ★ ★

Charles E. Wilson to Address ASM

Defense Mobilizer Charles E. Wilson has accepted the invitation of the **American Society for Metals,** 7301 Euclid Avenue, to be the major speaker at the closing session of the World Metallurgical Congress in Detroit on October 19.

★ ★ ★

William H. Eisenman, the Society's Executive Secretary, said Wilson will speak on the strategic importance of world metal conservation and production to the interests of free world defense.

★ ★ ★

The Metallurgical Congress is sponsored by the American Society for Metals and will be the first world meeting of metal specialists and production chiefs. It will be the largest industrial gathering ever held. More than 35,000 persons are expected to attend.

★ ★ ★

Standard Strand Buys Muncy War Plant

The Standard Strand Corporation has acquired the stock and assets of the Kiess-Kaufman Wire and Cable Company in Muncy, Pa., assuming the contracts of the latter as suppliers of strand for field wire for the Signal Corps.

★ ★ ★

This strand is shipped from Muncy to the **Standard Cable Corporation** of Chickasha, Oklahoma, whose president, L. W. Lord, is also president of the Standard Strand. The wire is processed into the finished product by Standard Cable. The business will be operated by **Ernest H. Cawthra,** plant superintendent and assistant secretary of the new corporation. All other officers are located in Chickasha.

★ ★ ★

J & L Announces Retirement of W. H. Dupka

Jones & Laughlin Steel Corp., Pittsburgh, announces retirement of **W. H. Dupka** as a vice president and director, and a member of the executive committee of the corporation. He has been associated with J&L since 1923.

★ ★ ★

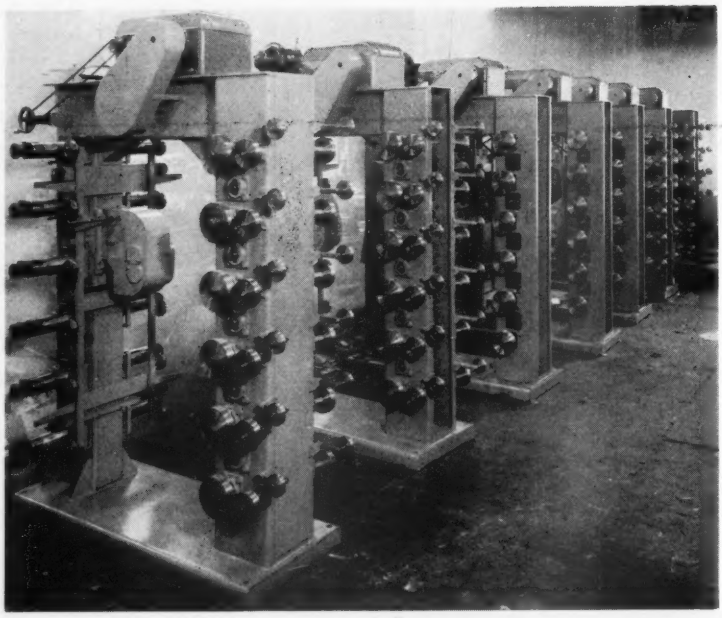
AMCARB

TUNGSTEN CARBIDE PRODUCTS

Diemakers for Industry

AMERICAN CARBIDE DIE CO.

UNION CITY, N. J.



AN ORDER OF TAKE-UP REEL STANDS
MULTIPLE UNIT WITH CONSTANT SPEED CAPSTANS.
MAIN DRIVE THROUGH VARIABLE TRANSMISSION

WIRE DRAWING, ENAMELING, TINNING, INSULATING, TAPING, GLASS-COVERING, PANNING, AND ALLIED MACHINERY.

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DAVIS EQUIPMENT . . .

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AUTOMATIC SPARK TESTER — For the accurate location of dielectric faults in insulating wire coating. Used in continuous line with plastic extruders or curing equipment. Voltage range of 3,000 to 16,000 volts.

CAPSTAN — Motor-driven, variable speed, for use with high-speed plastic extruders. Standard speeds of 100 to 1500 r.p.m. Higher speed gearing can be provided.

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SPARK TESTERS • SPOOLERS • TAKE-UPS • CAPSTANS

New Electronic Counter

The Post Machinery Company of Beverly, Mass., in collaboration with the General Control Company, have adapted their Counter for general-purpose counting in several variations, including total count, rate of count and pre-determined count.

★ ★ ★

The General Control Company, Boston 34, Mass., will handle the sale of the Counters and manufacture the related controls. The

New Electronic Counter

Counters will be known as the Post Promatic Electronic Counters.

★ ★ ★

Capable of counting in excess of 10,000 units per second, the operation of this new Counter may be either accumulative or pre-determined. The high-speed count is obtained through the use of photo-cell and electronic circuits. Miniature parts, as well as large bulky units, may be accurately counted. The Counter automatically energizes an external circuit for the purpose of segregating batches at the end of the predetermined count.

★ ★ ★

A visual six-digit totalizer indicates the exact count, while a Rate Meter shows at all times the rate of count per hour. The Counter is housed in an attractive gray cabinet, and may be located as far as 75 feet away from the photo-cell head. Industrial type tubes, and rugged components, are used in its construction. Operation is 115 volts, 60 cycles.

★ ★ ★

Cowles Adds New Sales Territory

In order to cover more completely the expanding market in the metal cleaner field, **Cowles Chemical Company,** Cleveland, Ohio announced that **Robert H. Campbell** was appointed Cowles Technical Man for the Metal Cleaner Department in its new sales territory comprising southern Illinois and St. Louis, Missouri.

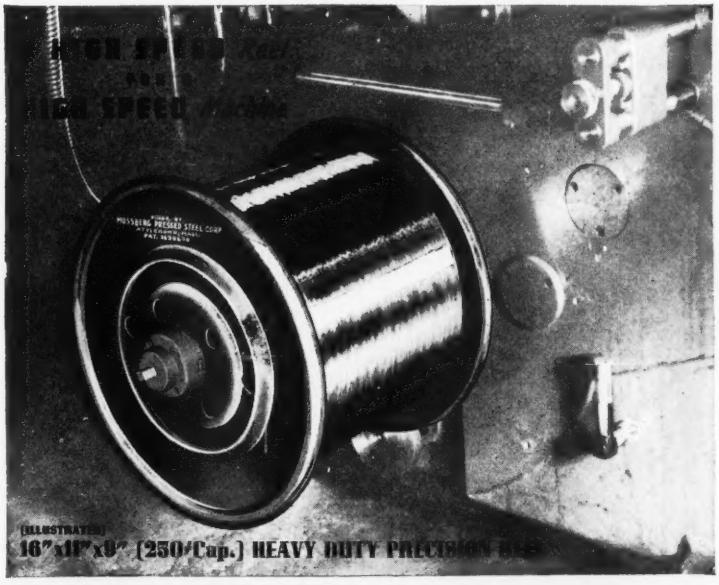
★ ☆ ☆

Mr. Campbell is well qualified for his new assignment. He attended the University of Illinois and Rockford College, specializing in chemistry. Following college he worked for a number of years at National Lock Co., first in the plating laboratory and then as assistant foreman on the plating line.

★ ★ ☆

Performance of Cemented Tungsten Carbide Bearings Studies

According to the announcement of **H. W. Highriter,** Technical Director, the **Vascoloy-Ramet Corporation** of Waukegan is cooperating with the **Acme Industrial Company** and the **D. A. Stuart Oil Company** of Chicago, Illinois, in a series of tests of sleeve bearings, made of Cemented Tungsten Carbide, to determine the practicability of the application of



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in HEAVY DUTY construction for use on modern HIGH SPEED wire drawing machines.

To provide higher operating efficiency, with the ever increasing tendency towards the drawing of finer gauge wire on larger reels at higher speeds, the following reel requirements are now essential.

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All these requirements are incorporated in spools and reels made by

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carbide bearings in high speed machines.

★ ★ ★

The Acme Industrial Company has finished test bearings to dimensional accuracy of one millionth part of an inch, and a surface finish of one to three micro-inches.

★ ★ ★

Tests have now been run at different speeds and conditions of loading and lubrication for over one year and a considerable amount of test data relating to the performance of carbide bearings has been accumulated.

★ ★ ★

One of the test bearings has now been run in the testing machine for 200 hours under pressure of 450 p.s.i. without showing any change in size, measurable to 1/100,000 inch. Other bearings have been run at pressures up to 2,000 p.s.i. and tests at still higher pressures are on the program.

★ ★ ★

These data are now being studied by Mr. H. Erickon, Chief Engineer of the D. A. Stuart Oil Company, and Professor J. S. Kozacka of the University of Illinois at Navy Pier in Chicago, to determine bearing characteristics.

★ ★ ★

Reference Library and Library Service Available to Visitors at World Metallurgical Congress and Exposition, Detroit, October 15-19

One of the participating societies, the Metals Section of Special Libraries Association, will have a miniature working reference library in their booth at the Exposition, with a metals librarian in constant attendance Monday thru Friday. There will be exhibitions of reference services, foreign and American technical books and periodicals, as well as translations of foreign works. Card catalogs will be available for study and bibliographies have been prepared to give away.

★ ★ ★

At the technical meetings there will be papers by such eminent authorities on metallurgical subjects as Dr. C. A. Zapffe, Mr. Benjamin Fullman, Chief Information Officer of the British Nonferrous Metals Research Association, Dr. I. M. Parker, Plantation Pipe Line Co., editor of "Corrosion", Mr. W. M. Peirce, New Jersey Zinc Co. and Miss Alvina Wassenberg of Kaiser Aluminum and Chemical Corporation.

★ ★ ★

Sessions are open to visitors.

★ ★ ★

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Nopco 1067-A has a unique ability to reduce surface tension in mineral acid solutions. This means it affords *high drain-off* of the acid solution during pickling, resulting in appreciable savings of sulfuric acid in pickling baths.

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Savings in operations following pickling—since thorough acid removal prior to such operations prevents contamination of lubricants, and thus increases life of dies and other tools . . .

PLUS faster, deeper, and more uniform penetration of oxide scale.

In the light of current restrictions on the use of sulfuric acid, you'll find Nopco 1067-A exceptionally helpful in any type of acid pickling—plating, wire manufacture, galvanizing or anodizing.

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Alcoa Builds Largest Electrical Conductor for Transmission Line

The largest electrical conductor ever supplied for an overhead transmission line is currently being manufactured by Aluminum Company of America. Nearly 2 million pounds of the conductor, 1.6-inch diameter Expanded A. C. S. R. (Aluminum Cable Steel Reinforced), have been purchased by Appalachian Electric Power Company, a subsidiary of American Gas & Electric Company. It will be installed on a super-voltage transmission line in West Virginia, connecting the Philip Sporn Generating Station on the Ohio River with the Kanawha River Station. The line will operate at 315,000 to 330,000 volts, the highest transmission voltage ever used in America. The cable is being shipped on 84 inch diameter steel reels.

★ ★ ★

Expanded A. C. S. R. is designed to provide economically the large diameters required for conductors at super-voltages.

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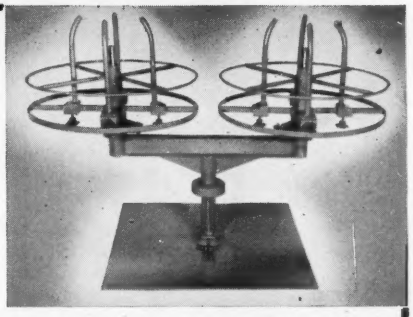

1) HEAVY DUTY DOUBLE REEL, 2) TILT TYPE, 3) SINGLE REEL.

Engineered by men experienced in all phases of wire working, NORSHOLM REELS embody advanced design features that assure increased production. Are rugged and precision made, built for endurance and high efficiency. Models vary from small single reels for light wires to large reels for 500 lb. coils of wire. All are ball-bearing equipped.

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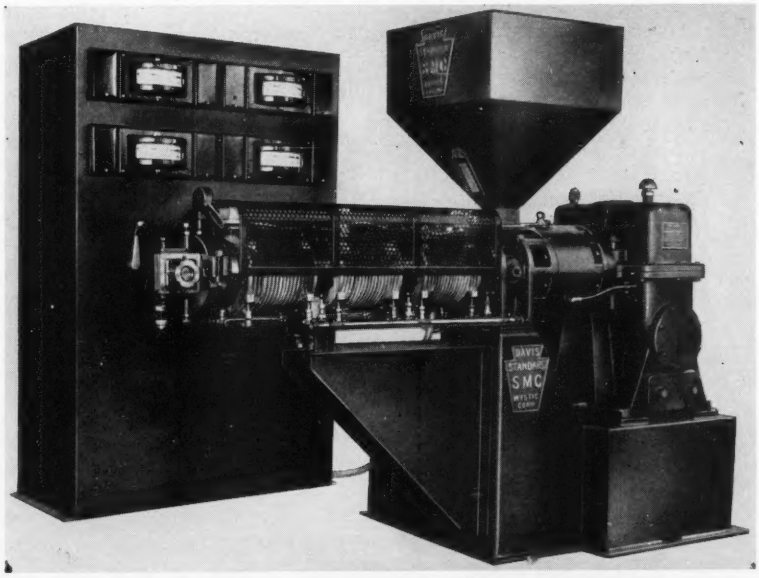

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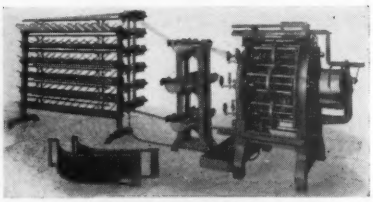

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Some Principles of Continuous Wire Drawing

(*Continued from page* 757)

the speed of the wire emerging from these dies decreased and the capstan slips correspondingly increase by amounts that can be read from the vertical scale. And so on for other variations.

Conclusion

Arising from this study is the concept of the continuous wire drawing process as a working partnership between machine and wire capable of instantaneous adaptation to changing circumstances within prescribed limits. The most sensitive features of the partnership from a metal working point of view are the last die and the capstan bands. If we suppose that slip in itself is undesirable, then we must try to control these two features. To control wear of the last die, the use of diamond springs to mind, but diamond would not obviate the need for slip if it were subject to the same ultimate limits of wear as carbide: it would merely postpone the day when the effects would become apparent (possibly a desirable aim in some circumstances). Apparently the only way to control capstan wear, trite as the statement may appear, is to make sure by one means or another that capstan diameters are maintained within close limits. But if we regard slip as in itself unobjectionable, then we must admit that flexibility in the partnership is ensured by providing amply for it in design. Doubtless there is nothing new in these conclusions, but there is perhaps some satisfaction in knowing that they can be deduced simply from first principles.

★ ★ ★

The authors wish to thank Metal Manufactures, Ltd. for permission to submit this article for publication and their colleague, Mr. Ernst Fischl, for helpful advice in the arrangement of the subject matter.

★ ★ ★

Newest Jewelry Metal

Palladium is a new jewelry metal as compared to gold which was used for jewelry thousands of years ago. Jewelry craftsmen eliminate excess weight from ear clips, brooches, etc., by using palladium.

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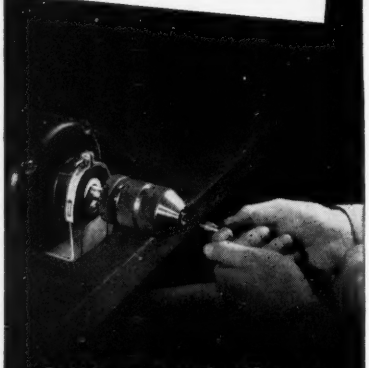

Carbide spray nozzle orifices are finished to tolerances of .0005" at Spraying Systems Company, Bellwood, Illinois. New Elgin DYMO-C diamond abrasive used in place of diamond powder-oil mixture produces more pieces per hour and conserves diamond, too!

ELGIN DYMO-C*
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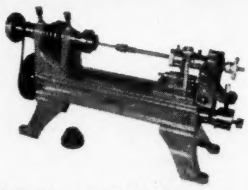

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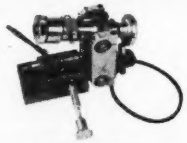

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You can quickly and easily replace the tailstock on your old Roos Semi-Automatic Polisher with the New Model OT-Tailstock. Quotation on this new Tailstock furnished on request.

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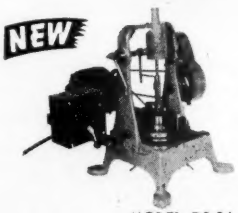

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Offers you three improved features: a die rotating attachment; a time switch; and a reversing switch—which provide these advantages:

1. Die rotating attachment and time switch eliminate the formerly necessary constant attention by operator. Rotation of die is automatic, and machine shuts off automatically at end of time cycle.
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Explosion-Proof Motor Announced

A 10-feature totally-enclosed motor for explosion-proof requirements has been developed by **U. S. Motors.** Made in capacities from 3 to 75 horsepower, this new motor, Types SE and SES, carries the Underwriters' label in Class 1, Group D, for highly inflammable gases and volatile liquids, and in Class II, Groups F and G, for combustible dusts. Other types SD and SS without label, for non-explosion-proof services, are also available. Features incorporated include: Sealed terminal, elongated spark-arresting bearing sleeves, streamlined housing, hi-draft ventilation, removable cover, split hub fan, normalized castings, Lubri-flush bearings, asbestos-protected windings and solid, centricast rotor. Being completely sealed, this motor gives protection against external hazards, preventing intrusion of abrasives, acids, moisture and other deleterious substances. A new Bulletin, No. 1629, describing the motors, may be obtained by writing U. S. Electrical Motors, Inc., 200 East Slauson Avenue, Los Angeles 54, Calif.

★ ★ ★

Calculation of Stresses in Wire Rope

(Continued from page 767)

culty in calculating the corresponding formulas.

★ ★ ★

We come now to the wire rope. In principle we stand before the same problem as in strands and all we need is to substitute the words "wire" for "strand" and the word "strand" for "Rope". The fact, that the individual wire forms a double helix in the rope is of no importance. We certainly can assume, that all wires in a cabled strand will elongate in the manner as in the straight strand, and uniform elongation of all wires in the direction of the axis of the strand is the only condition necessary for the diagram.

★ ★ ★

If the elongation of all wires should not be equal there would be a relative movement between the wires. This cannot take place even in a straight strand because of the great internal friction, and with less

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STANNOUS SULFATE

Use of Stannous Sulfate for liquor finishing baths saves tin, assures more efficient processing.

for **ALL LIQUOR FINISHING of STEEL WIRE**

white or straw color

M & T Stannous Sulfate provides these advantages:

- **Reduces tin losses by eliminating the high tin sludging common to the acidulated feather tin process.**
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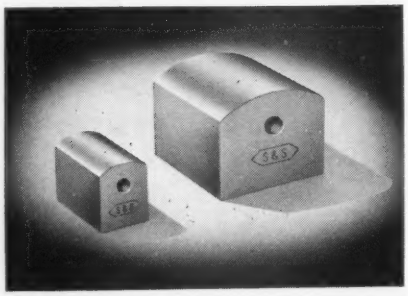

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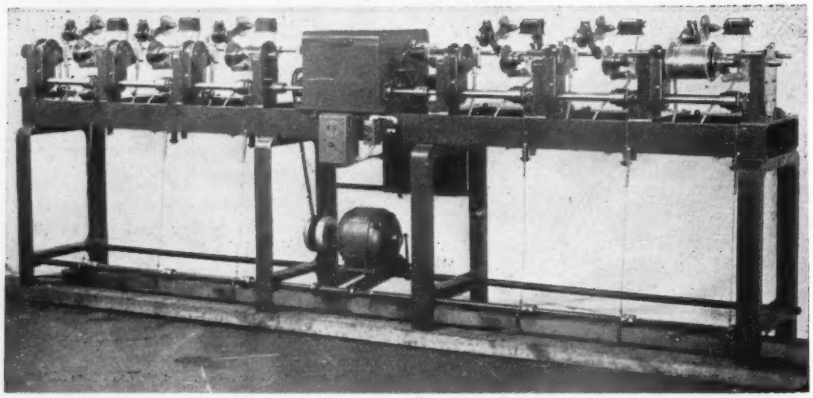

Illustrated: Six-Spindle Multihead Winding Machine

The Winder shown above has a main control box with a single screw reversed by a solenoid control for traverse of wire guides. Each head individually controlled by a pre-determined measuring device.

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right in a cabled strand. I think it is an error of principle when Mr. Henry M. Hall in his article "Stresses in Small Wire Ropes" (see Wire and Wire Products, March 1951) makes the assumption of a wire without friction. Without internal friction a wire rope would cease to be a wire rope. A broken wire takes through friction in a distance of few layers its full share of the pull and a wire rope may have all its wires broken and still carry the load. I also disagree with the assertion of the mentioned author, that wire cores are less stressed, (as explained in this article).

★ ★ ★

As in principle there is no difference between the rope and the strand we can apply all our formulas. First we calculate the distribution of the whole load to the individual strands, that is, we compute first the stress in the strand and multiplying this with the section of the strand we obtain the total pull in the strand. From there on we are on ground covered by the 10 formulas. It would be possible, of course, to combine the formulas for the strand and the wires, but it would lead too far and would be of no practical or instructive value. The only exception I would like to make is the common 6 strand wire rope. The formula for this runs as follows:

$$P = 6\,\sigma_c' \cdot \cos\beta\,(s_c + s_1 \cdot \cos^3\alpha_1 + s_2 \cdot \cos^3\alpha_2 + \cdots) \quad (11)$$

β is here the lay angle of the strands in the rope.

★ ★ ★

According to this formula, for instance, a wire rope of 6 x 19 x 0.05" with a wire core of 0.052" in each strand, a lay of 2.5" for the wires and 5.25" for the strands and a load of 7,000 lbs. would give the following results:

Stress in core: σ_c 35.200 psi

Stress in layers: σ_c 33.200 psi (presuming same lay angle for both layers).

★ ★ ★

The stress calculated in the customary way, that is, "load divided by total section" gives 31.100 psi.

★ ★ ★

I do not expect, that all these formulas will be a practical help for

the wire rope man in his daily work. But I think that they help a great deal in making us understand better how wire ropes work. The main obstacle to the introduction of exact methods of calculation was and still is the fact that basic errors like that of considering core wires less stressed do not lead to disasters. At the worst, they lead to shorter rope life. Wire ropes have the most valuable quality of announcing their coming death by broken wires and so avoiding disasters. Still I believe that the day will come when the rule of thumb will become obsolete for the calculation of wire ropes.

★ ★ ★

VPI Wrap for Wire Protection

(Continued from page 761)

contact effects of VPI. In none of our tests, has VPI vapor accelerated corrosion. However, VPI in contact with the surface may or may not promote corrosion of cadmium plate, Monel, copper and copper alloys, lead, antimony, and tin, based on laboratory tests conducted under severe conditions. These laboratory tests were presumably so severe that they do not represent typical storage conditions because in actual commercial practice there has been very little difficulty using VPI where non-ferrous metals are present. It is clearly good practice, in designing a package for a product containing non-ferrous metals, to avoid as much direct contact as possible. Trial packages for tests under actual storage and shipping conditions should be made whenever there is any doubt.

★ ★ ★

Oil is frequently on the surface of machine parts to be packaged, but its removal is not necessary for VPI vapors to be effective. In some instances where corrosion prior to VPI packaging is a factor, light preserving oil is being sprayed on the aritcle in process. If the VPI wrap becomes saturated with oil, the rate of vaporization is slowed, but all tests and experience have shown that full protection is still maintained.

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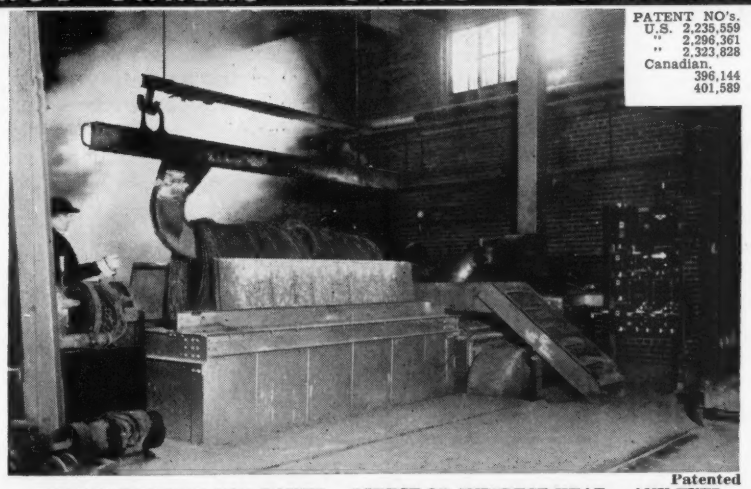

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VPI is safe to handle, based upon both laboratory tests and three years of extensive commercial usage. Toxicity of the chemical itself, when taken internally, is the same order as that of sodium nitrite, commonly used as a preservative in foods. Even continuous inhalation of air saturated with VPI vapor would not be expected to be harmful and no effects have been noted in either its manufacture or use.

* * *

Although relatively new, VPI is a proven and established method of protective packaging. Limited testing began over five years ago, and during the past three-and-a-half years since VPI Wrap was first offered commercially, it has been tested on a very broad and independent basis by practically all segments of industry. Corrosion testing is difficult, and usually the only procedure that is entirely satisfactory to any one company is to package its own products and subject them to the storage and shipping conditions in which the company is most interested. Such tests frequently take over a year's time and involve shipments and exposures of many types. It is on the basis of such tests that VPI has found wide acceptance and use. As this type of experience is accumulated, we are in an ever better position to recommend proper packaging procedures. It is anticipated that VPI experience and acceptance will continue to grow at an accelerating rate and assume an ever-increasing importance in the packaging of ferrous-metal products.

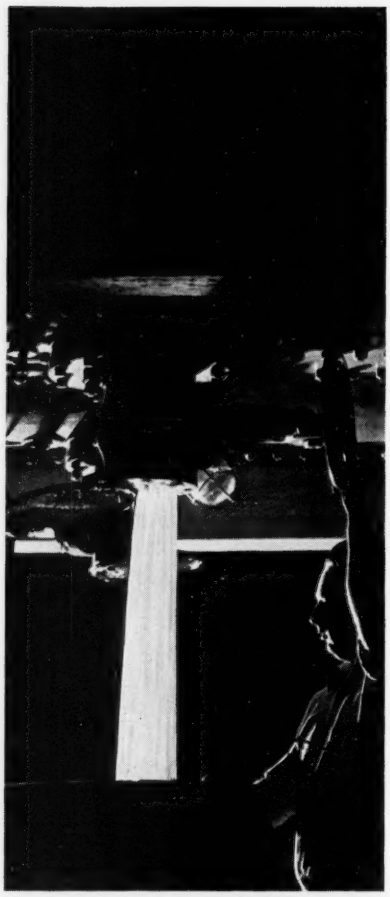
* * *

Instrument Springs and Spring Instruments

(Continued from page 765)

the mechanism of the relined spring scale.

In April of 1949, the National Conference of Weights and Measures passed a resolution recommending that scales which were not equipped with thermal correction and which were not permitted in



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The above photograph is one of many contained in an eight-page brochure describing our facilities to serve you. Write for your copy of the complete brochure!

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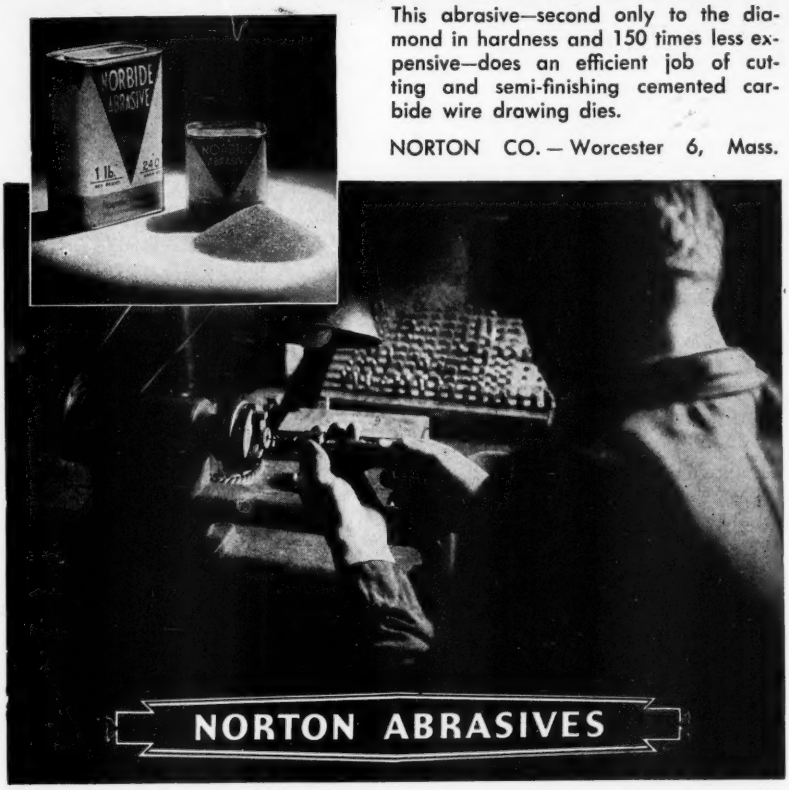

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many states for the sale of food stuffs other than fruits and vegetables be so marked on their face, to permit recognition by the consuming public.

★ ★ ★

The difference in tolerances governing uncompensated and compensated spring scales is not one of temperature variation alone. The compensated scale must register weight accurately within much closer tolerances on all loads. Tests are frequently made by loading the scale to capacity in small increments and subsequently unloading in the same manner. When a scale is thus tested for type approval, the test may require several hours. Under these circumstances it will be seen that not only will spring hysteresis (non-coincidence of loading and unloading curves) contribute to the back weighing error but because the springs have been under load for perhaps an hour or more spring creep if present will also be apparent.

★ ★ ★

Where springs constitute the force measuring element in a spring scale, errors not originating with the spring may so resemble the effect of spring creep or hysteresis that frequently springs are suspected where the actual cause of trouble lies elsewhere. Some of the most frequent errors encountered will be treated in the following paragraphs with the thought that they may be of use to manufacturers and inspectors of scales and other spring instruments.

★ ★ ★

When an applied force is measured by corresponding deflection of the spring, it should be noted that while the spring accounts for perhaps 99% of the entire deflection of the system there is a measurable amount of deflection in some of the other members of the system. While such other parts may account for a small amount of the total deflection they are frequently constituted of material which does not possess ideal spring properties. In a scale, for example, the eye hooks to which the upper end of the spring is attached are frequently made of soft

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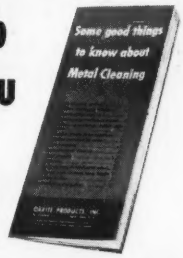

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iron possessing pronounced hysteresis. If the springs are lined up in the case by bending the eye hook even though the total deflection of this member is small its contribution of hysteresis may be greater than that in the weighing springs.

★ ★ ★

When a diaphragm or bellows is used in an instrument in connection with a spring, its percentage hysteresis may be 20 times as great as that of the spring, so that even though the bellows contributes less than 10% of the total resilience, it may well account for most of the total hysteresis in the system. In some straight spring balances where the helical axis of the spring does not coincide with the center of gravity of the entire system there may take place a pendulum action which will cause the case of the instrument to swing around its supporting point while the movement of the spring is almost vertical along its helix axis. When this happens equal increments of loading will not produce equal increments of deflection on the dial of the scale. In actual practice, this failure has been frequently overcome by constructing the spring and runner in such manner that after a certain amount of loading has been applied the spring lifts slightly off the runner thus compensating for the pendulum action of the case. While this, of course, is not the ideal solution to the problem, it has been employed in the case of straightface spring balances where tolerances are considerably larger than with circular dial scales.

★ ★ ★

There are many other sources of error in dial instruments of all types. Two of those most commonly encountered are the improper design of the spring runner and the eccentricity of the circular dial with respect to the pointer shaft. Springs are usually calibrated by varying the number of active coils. This is accomplished by turning the spring coils into a runner until the resulting active coils produce the desired deflection. The runner should be so constructed that at no point during the loading do coils lift off it, giving the effect of more active coils during the high loading range than during the low loading range. Should this happen the spring will be more

resilient in the upper range than in the lower and the springs which give the desired reading at full capacity will read short at half capacity and under. The reading of such an instrument is shown on the accompanying chart. Where this condition exists, the readings do not always follow the diagram because such error may be accompanied by others. There may, for example, be an error due to the circular dial's not being concentric with the pointer shaft. If the scale is one on which the pointer makes three revolutions of the dial, the error due to eccentricity is charted on Chart 2. Where such eccentricity is accompanied by springs lifting off the runner the final errors will be the algebraic sum of the two errors shown by line III of the chart.

★ ★ ★

The Instrument Spring

When the National Conference on Weights & Measures recommended that all scales used in the sale of food stuffs other than fruits and vegetables be thermally compensated, it also reduced the limits of permissible creep and hysteresis in such scales by establishing tolerances for thermally compensated scales which were is some case approximately 1/3 as great as had previously been permissible in scales possessing all steel springs. Examination of many of the cheaper non-compensating scales on the market indicated that quite aside from the temperature effect on the steel springs the hysteresis error and back error contributed by these members to the scale errors were well beyond the new tolerances for compensated scales. Since there are decided advantages in using a spring constructed partly of steel, research was initiated to produce a steel spring having considerably better creep and hysteresis properties than any constructed before the new regulations became effective. Through several cycles of cold work and subsequent thermal stress relief a steel spring was eventually produced which exhibited creep and hyteresis errors so small that they were not only well within the new tolerances but, also, at high work stresses were smaller than anything previously attained in a scale spring. This accomplishment permitted the use of a high-grade scale spring, not only in the extra large cases built specially to house them but, also, in the small case of the moderately priced scale. This in turn permitted the scale manufacturer in many instances to convert from a non-compensating to a compensating scale simply by changing to better springs.

★ ★ ★

This improvement in scale springs brought about by stricter regulation of scales advanced the accuracy of spring controlled instruments generally, since even where space limitations prevented the use of a compensating spring and where general uniform temperature conditions did not require one a better performing instrument could still be attained by the use of the improved steel instrument spring.

★ ★ ★

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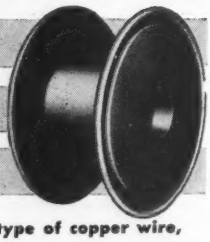

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aircraft instrument springs had resulted in such an improvement in performance between temperatures of —50°F and ±150°F as to prompt exploration of the performance of these springs at still higher temperatures. This investigation was hastened by advent of the jet-propelled plane and the corresponding higher temperatures within the fuselage at higher air speeds. About six months ago, some designers of equipment for this type of plane were confronted with the problem of installing an electric motor to operate in an atmosphere of 600°F. At this temperature all ordinary brush springs became so soft that commutation failed and the motor became inoperative. Although tests on elinvar materials had not been completed at these high ranges, enough had been learned to indicate that this type of spring might offer the solution. Because of the urgency of the situation springs were made up and installed in motors which were tested day and night under temperature cycles ranging from —50°F to 600°F. The combination of constant modulus and low creep at high temperatures enabled these springs to give a satisfactory performance where other types had failed, and once more the spring scale had served as a serviceable proving ground for one of the vital needs of the nation's defense.

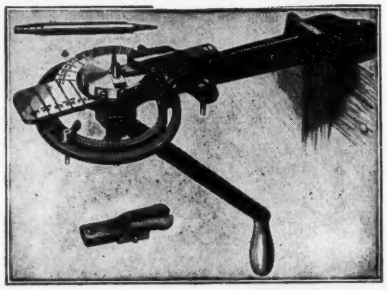
★ ★ ★

CHART I shows the error in an otherwise perfect 30-lb., 3 revolution circular dial caused by the pointer shaft's eccentricity with respect to the scale dial. In this case the pointer shaft is slightly below the center of the dial resulting in maximum errors at the horizontal points on the dial (e.g. at 2½, 12½ and 22½ lbs. where the error is positive and at 7½, 17½ and 27½ lbs. where the error is negative). Since other errors are usually encountered in scale construction such an ideal curve in a scale test is unusual.

★ ★ ★

CHART II shows the errors in an otherwise perfect scale in which the spring lifts off the runner before full capacity is reached. In this case lifting off the runner occurs at about 26½ lbs. at which point an addition-

KILMER WIRE FORMER



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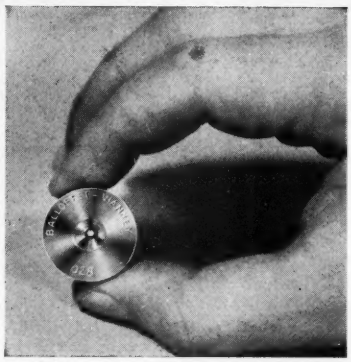

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al coil was thrown into action and the spring thus becomes more resilient. The magnitude of an error of this type depends upon the number of active coils in the spring, the magnitude being in inverse proportion to the number of coils. A spring which lifts off the runner produces this characteristic curve and is easily recognizible.

★ ★ ★

CHART III shows the effect of the errors in Charts I and II. It will be noted here the well-defined repetitive pattern of Chart I is destroyed by the superimposition of the lifting off the runner error. Since there are at least 15 points at which an error may occur in the scale, considerable experience is usually required in the correct diagnosing of scale troubles.

★ ★ ★

Phelps Dodge Opens New England Office

The Phelps Dodge Copper Products Corporation has announced the establishment of New England Sales Offices at 828 Statler Office Building, 20 Providence Street, Boston, 16, Mass.

★ ★ ★

Craig W. Marshall (general accounts) and **Frank A. Stevens, Jr.** (utilities) will make their headquarters at this new office. Warehouse facilities for the company will be continued at 143 Sidney Street, Cambridge 39, Mass.

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★ ★ ★

Literature describing the instrument and its uses is available on request from Joseph B. Kushner, Electroplating Engineer, Stroudsburg 1ST, Penna.

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Keystone Honors Members of Their 25-Year Club

On June 3rd the **Keystone Steel & Wire Company** of Peoria, Illinois, inducted thirty-five employees into the Keystone 25-Year Club at the organization's 14th annual banquet. At the same time four men were honored for 50, 45 and 40 years of service with the Company.

★ ★ ★

At the ceremony, the new members were presented with certificates "issued in appreciation of 25 years or more of efficient, conscientious services rendered". To commemorate the event, the Company has issued a handsome brochure that the employees will prize as much as the certificate itself. The presentations were made by the members of the Executive Committee, **H. G. Sommer, R. E. Sommer** and **D. P. Sommer.**

★ ★ ★

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Elgin National Watch Co., Abrasives Division, Elgin, Ill.
Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION—
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corporation, Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
Scudder, E. J. Foundry & Mach. Co., Trenton, N.J.

ARMORING EQUIPMENT—
American Insulating Machy. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ross, J. O., Engr. Corp., New York, N. Y.

BAR STOCK—Stainless Steel
American Steel & Wire Company, Cleveland, Chicago, New York
U. S. Steel Corporation, New York, N. Y.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

BORAX—Wire Drawing
Pacific Coast Borax Corp., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Pawtucket, R. I.

CABLE LACQUERING OVENS—
Industrial Ovens, Inc., Cleveland, O.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Acid Proof
Ceilcote Company, Cleveland, Ohio

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
(See Cleaners—Metal)

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Du Pont de Nemours, E. I. & Co., Electrochemical Dept., Wilmington, Del.
Houghton, E. F., Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Metal & Thermit Corp., New York, N. Y.
Oakite Products, Inc., New York, N. Y.
Parkin Chemical Company, The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIP.—
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Holden, A. F., Company, The, Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio
Youngstown Welding & Engineering Co., Youngstown, Ohio

CLOTH—WIRE, All Metals
Roebling's, John A. Sons, Co., Trenton, N. J.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, O.

COLD HEADERS—
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.
Techema Co., The, Toronto, Canada

COMPOUNDS—Diamond
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Division, Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Magnus Chemical Co., Garwood, N. J.

COMPOUNDS—For Improving Drawing and Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa
Du Pont de Nemours, E. I. & Co., Electrochemical Dept., Wilmington, Del.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Oakite Products, Inc., New York, N. Y.
Pacific Coast Borax Corp., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.
Swift & Company, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

CORROSION PREVENTIVE PAPERS—
Angier Corporation, The, Framingham, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Division, Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
National Research Company, St. Claire Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
National Research Co., St. Claire Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Carboloy Dept. of General Electric Co., Detroit Mich.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide
(See Dies—Tungsten Carbide)

DIES—Cold Heading
American Carbide Die Company, Union City, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York, N.Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
American Carbide Die Company, Union City, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Metal Carbides Corporation, Youngstown, Ohio.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
American Carbide Die Company, Union City, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hartley Tool & Die Co., Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
American Carbide Die Company, Union City, N. J.
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hartley Tool & Die Co., Thomaston, Conn.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

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DIES—Special Shapes, Etc.
American Carbide Die Company, Union City, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Indiana Wire Die Co., Ft. Wayne, Ind.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIES—Swaging
Murex, Ltd., Rainham, England
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tantalum Carbide
American Carbide Die Company, Union City, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIES—Tube Drawing
American Carbide Die Company, Union City, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIES—Tungsten Carbide
American Carbide Die Company, Union City, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS—Flange Steel
Hubbard Spool Company, Chicago, Ill.
Niles Steel Products Division, Republic Steel Corporation, Niles, Ohio

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., The, Paterson, N. J.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting
Copper—Leonard D. Walde, North Plainfield, N. J.
Metal Fatigue—Fatigue of Materials Laboratory, Princeton, N. J.
Wire Mill—Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Elec. Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Company, The, Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Michigan Oven Co., Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Clevel nd, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (oil, gas, electric)
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, Detroit, Mich.

FURNACES—Resistance Heating, Strand
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Michigan Oven Co., Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOOKS—Pickling & Liming
Bronze Die Casting Co., Pittsburgh, Pa.
Youngstown Welding & Engineering Co., Youngstown, Ohio.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

IMPREGNATING MATERIALS—
Standard Varnish Works, New York, N. Y.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Du Pont de Nemours, E. I. & Co., Electrochemical Dept., Wilmington, Del.
Houghton, E. F. & Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin Chemical Company, The, Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
American Insulating Machine Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Du Pont de Nemours, E. I., Co., Wilmington, Del.
Glass Fibers, Inc., Waterville, Ohio.
Merrimac Paper Co., New York, N. Y.
New England Lacquer Co., E. Providence, R. I.
Owens Corning Fiberglas Corp., Toledo, O.
Standard Varnish Works, New York, N. Y.
Twitchell, E. W., Philadelphia, Pa.

INSULATING MATERIALS—Paper—For Electric Wire Cable.
Merrimac Paper Co., New York, N. Y.
Twitchell, E. W., Philadelphia, Pa.

LACQUERS—For Electric Wire
New England Lacquer Co., E. Providence, R. I.
Standard Varnish Works, New York, N. Y.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LATHES—Die Reaming
Carboloy Dept. of General Electric Co., Detroit, Mich.
Roos, Tool & Mfg. Co., Montclair, N. J.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

LUMBER—Wire Mill, Carload shipments for lagging and ear blocking
North Anson Reel Co., No. Anson, Me.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wafios, Machinenfabrik, Württ., Germany
Wean Engineering Co., Cleveland, Ohio.

MACHINERY—Bead Wrapping
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Bolts & Rivets
Meyer, Roth & Pastor Machinenfabrik, Koln-Raderberg, Germany

MACHINERY—Braiding
Fidelity Machine Co., Inc., Philadelphia, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WHERE TO BUY, Continued

New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Brazing
Eisler Engineering Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
Cook, Edw., Machy. Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Meyer, Roth & Pastor Machinenfabrik, Koln-Radderberg, Germany

MACHINERY—Coilers
Boyd & Sons Manufacturing Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
National Machy. Exch. (used) New York, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Cold Heading
(See Cold Headers)

MACHINERY—Copper Wire Drawing and Rolling
Aetna-Standard Engineering Co., Youngstown, Ohio
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., The, Hartford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
National Mach'y Exch. (Used) New York, N. Y.
Porter, H. K., Inc., Everett, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Die Making
Carboloy Dept. General Electric Co., Detroit, Mich.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Roos Tool & Mfg. Co., Montclair, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Aetna-Standard Engineering Co., Youngstown, Ohio
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Edging
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio
Michigan Oven Co., Detroit, Mich.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
National Rubber Machinery Co., Akron, Ohio
Royle, John, & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Wafios, Machinenfabrik, Württ., Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Fenn Manufacturing Co., The, Hartford, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Galvanizing
(See Galvanizing Equipment)

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Cook, Edw., Machy. Co., Wallingford, Conn.
Ets. Pourtier Frères, Romainville, France
Fidelity Machine Co., Inc., Philadelphia, Pa.
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Inc., Philadelphia, Pa.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
Meyer, Roth & Pastor Machinenfabrik, Koln-Radderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Machinenfabrik, Württ., Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Engineering Co., Youngstown, Ohio

MACHINERY—Pin Making
Meyer, Roth & Pastor Machinenfabrik, Koln-Radderberg, Germany

MACHINERY—Pointing
Aetna-Standard Engineering Co., Youngstown, Ohio
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.

MACHINERY—Pre-Heater for Wire (for Extrusion of Plastics)
Industrial Ovens, Inc., Cleveland, Ohio
National Rubber Machinery Co., Akron, Ohio

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
National Machy. Exch. (used) New York, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Rubber Insulating
National Rubber Machinery Co., Akron, Ohio
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Rubber Tubing and Straining
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Boyd & Sons Manufacturing Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Fidelity Machine Co., Inc., Philadelphia, Pa.
National Mach'y Exch. (Used), New York, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Spring Making
Carlson Company, The, New York, N. Y.
Lundahl Corp., Hartford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Machinenfabrik, Württ., Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Machinenfabrik, Württ., Germany

MACHINERY—Straightening & Cutting
Fenn Manufacturing Co., The, Hartford, Conn.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
Meyer, Roth & Pastor Machinenfabrik, Koln-Radderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Norsholm Industries, Rochester, Michigan
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Hughesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Aetna-Standard Engineering Co., Youngstown, Ohio
Steel Equipment Co., Cleveland, Ohio
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Swaging
Fenn Manufacturing Co., The, Hartford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

WHERE TO BUY, Continued

Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Testing, Physical
Lundahl Corporation, Hartford, Conn.
Scott Testers, Inc., Providence, R. I.

MACHINERY—Testing Equipment—Electrical
Davis, R. L. Elec. Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Marshall-Richards Machine Company, Inc., Trenton, N. J.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook, Edw., Machy. Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingford, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply, Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Winding Wire
Federal Manufacturing Co., Wallingford, Conn.
Standard Mill Supply, Pawtucket, R. I.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Aetna-Standard Engineering Co., Youngstown, Ohio
Davis, R. L. Electric Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
Marshall-Richards Machine Co., Inc., Trenton, N.J.
Standard Machine Co., Mystic, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio.

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Youngstown, Ohio
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., The, Hartford, Conn.
Kurt Orban Co., Inc., New York, N. Y.
Marshall-Richards Machine Co., Inc., Trenton, N.J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Svenska Telegrambyran (Morgardshammer), Stockholm, Sweden
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Forming
Kilmer, M. D. & Co., Cleveland, Ohio.
Meyer, Roth & Pastor Machinenfabrik, Koln-Radderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Machinenfabrik, Württ., Germany

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N. Y.

MACHINERY—Wrapping Straight Lengths and Tubing
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Wrapping Wire Coils
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Co., Cleveland, Ohio.

NAILS—Wire
American Steel & Wire Co., Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling, John A. Sons Co., Trenton, N. J.
Wickwire Brothers, Inc, Cortland, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.

OVENS—Dehydrogenizing
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Industrial Ovens, Inc., Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Rod Bakers
Carl-Mayer Corp., The, Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINT—Acid Proof
Ceilcote Company, Cleveland, Ohio.
Standard Varnish Works, New York, N. Y.

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.
Standard Varnish Works, New York, N. Y.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Angier Corporation, The, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, The, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See Wind-up and Unwind Systems)

PHOSPHATE COATING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Bronze Die Casting Co., Pittsburgh, Pa.
Youngstown Welding & Eng. Co., Youngstown, O.

PICKLING TANK LININGS—
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

PNEUMATIC CYLINDERS—
Entwistle, Jas. L. Co., Pawtucket, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio.

PRESSES—Hydraulic and Mechanical
Standard Machinery Co., Mystic, Conn.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

REEL AND TENSION STANDS—
Davis, R. L. Elec. Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Roll-a-Reel, Cincinnati, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Roll-a-Reel, Cincinnati, Ohio
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Drawn Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Chicago, Ill.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.

REELS & SPOOLS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS & SPOOLS—Plastic
Hubbard Spool Co., Chicago, Ill.

REELS & SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
Mason Can Company, East Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
Mason Can Company, East Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.
North Anson Reel Co., No. Anson, Me.
Proctor Reels, Proctorville, Vt.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
North Anson Reel Co., No. Anson, Me.
No. Waterford Spool Co., No. Waterford, Me.
Proctor Reels, Proctorville, Vt.

REELS—Metal Bound
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
North Anson Reel Co., No. Anson, Me.

REELS—Pay-off
Norsholm Industries, Rochester, Mich.

REELS—Takeoff
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.
North Anson Reel Co., No. Anson, Me.
Proctor Reels, Proctorville, Vt.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Drawing
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

WHERE TO BUY, Continued

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Chicago, Ill.
Mason Can Company, East Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.
North Anson Reel Co., No. Anson, Me.
Proctor Reels, Proctorville, Vt.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

RESISTANCE HEATING—Annealing Patenting, Etc.
Trauwood Engr. Co., Cleveland, Ohio.

ROD BAKERS—
(See Ovens—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio.
U. S. Steel Co., N. Y., N. Y.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Company, Pittsburgh, Pa.
Roebling's John A., Sons Co., Trenton, N. J.
Montan Export, Inc., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's John A., Sons Co., Trenton, N. J

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SALTS—Heat Treating, Descaling, etc.
Holden, A. F., Co., The, Detroit, Mich.
Houghton, E. F. & Co., Philadelphia, Pa.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

SOAPS—Industrial and Wire Drawing
(See Compounds—Wire Drawing)

SODIUM—for Descaling
Du Pont de Nemours, E. I. & Co., Electrochemical Dept., Wilmington, Del.
Holden, A. F., Co., The, Detroit, Mich.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANKS—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Ceilcote Company, Cleveland, Ohio.
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.

TANKS—Steel
Chemsteel Construction Co., Pittsburgh, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TIES—WIRE—
(See Wire Ties)

TINNING PROCESS—
Du Pont de Nemours, E. I. & Co., Electrochemical Dept., Wilmington, Del.
Metal & Thermit Corp., New York, N. Y.

TINSEL—Cords, Decorative
(See: Tinsel—Electric Conductor)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL—Electric Resistance
(See: Tinsel—Electric Conductor)

TINSEL—Lame, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Decorative
(See: Tinsel—Electric Conductor)

TINSEL—Wire
(See: Tinsel—Electric Conductor)

TOOLS—Spring Forming
Lundahl Corporation, Hartford, Conn.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, Jas. L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

TUBE BENDERS AND FORMERS—
H. D. Kilmer Co., Cleveland, Ohio.

TURKS HEADS—
Fenn Manufacturing Co., The, Hartford, Conn.

VALVES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—for Electric Wire
N. E. Lacquer Co., E. Providence, R. I.
Standard Varnish Works, New York, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Federal Manufacturing Co., Wallingford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

WIRE—Alloy
Montan Export, Inc., New York, N. Y.

WIRE—Aluminum
Elmet Division, North American Philips Company, Inc., Lewistown, Maine
Malin & Co., Cleveland, Ohio

WIRE—Barbed
Interlocking Fence Co., Morton, Ill.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio

WIRE—Flat, Fine
Elmet Division, North American Philips Company, Inc., Lewistown, Maine
Montgomery Co., The, Windsor Locks, Conn.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Montan Export, Inc., New York, N. Y.
Newbury Company, The, Boston, Mass.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
U. S. Steel Co., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Cleveland, Ohio
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio
Montan Export, Inc., New York, N. Y.
Newbury Company, The, Boston, Mass.
Specialty Wire Co., Inc., Worcester, Mass.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.
Chase Brass & Copper Co., Waterbury, Conn.

WIRE—Non-Ferrous to Specifications for Special Purposes
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Cleveland, Ohio
Chase Brass & Copper Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., New York, N. Y.

WIRE—Oil Tempered
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Newbury Company, The, Boston, Mass.
Pittsburgh Steel Co., Pittsburgh, Pa.
Specialty Wire Co., Inc., Worcester, Mass.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Specialty Wire Co., Inc., Worcester, Mass.

WIRE—Steel—Also Coppered and Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Tungsten
North American Philips Co., Inc., New York, N.Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Weaving (Non-Ferrous)
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.

WRAPPING PAPER—Creped
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Angier Corporation, The, Framingham, Mass.

YARNS & TAPES—
Du Pont de Nemours, E. I. Co., Wilmington, Del.
Glass Fibers, Inc., Waterville, Ohio
Owens Corning Fiberglas Corp., Toledo, Ohio
Twitchell, E. W., Philadelphia, Pa.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

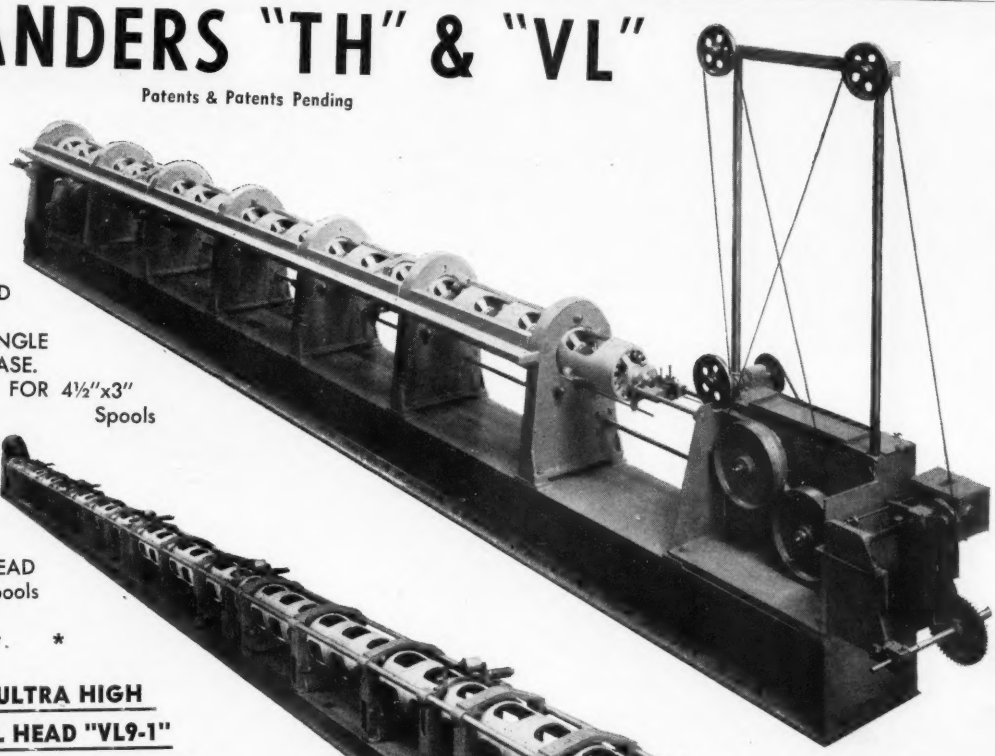
PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE AND CORDAGE MACHINERY MANUFACTURERS

WATSON

STRANDERS "TH" & "VL"

Patents & Patents Pending



19-SPOOL

"TH2-3"

No. W-2577
STRANDING
MACHINE
CLOSE COUPLED
COMPLETE
ON SINGLE
BASE.
FOR 4½"x3"
Spools

46-SPOOL

"TH6-8"

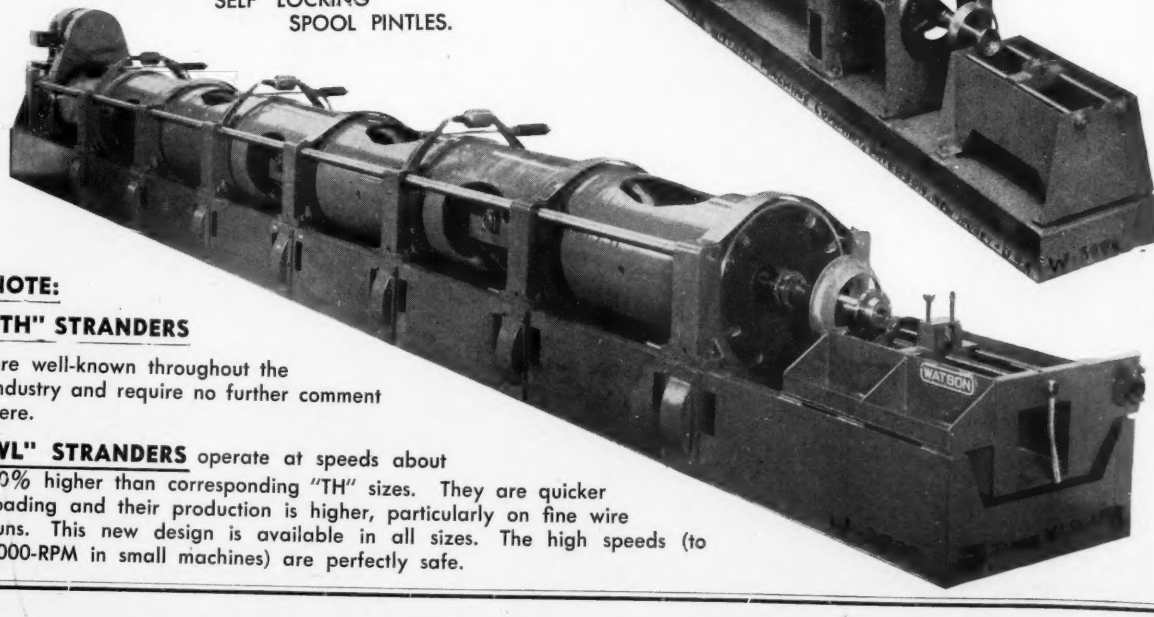
No. W-3006
STRANDING HEAD
For 12" x 6" Spools

* * *

NEW SERIES—ULTRA HIGH

SPEED 7-SPOOL HEAD "VL9-1"

No. W-3997. FOR 22" x 11" Spools.
SHAFTLESS CRADLES.
INTEGRAL TENSIONS.
NO LOOSE PARTS.
SELF LOCKING
SPOOL PINTLES.



NOTE:

"TH" STRANDERS

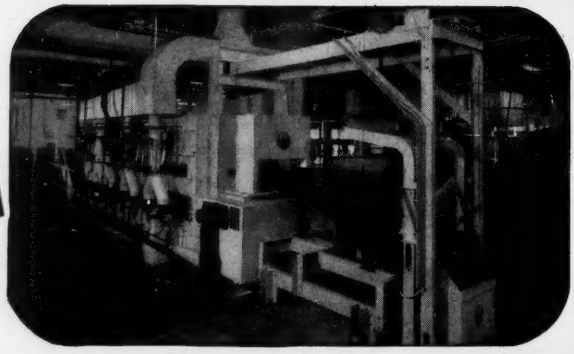
are well-known throughout the industry and require no further comment here.

"VL" STRANDERS operate at speeds about 50% higher than corresponding "TH" sizes. They are quicker loading and their production is higher, particularly on fine wire runs. This new design is available in all sizes. The high speeds (to 6000-RPM in small machines) are perfectly safe.

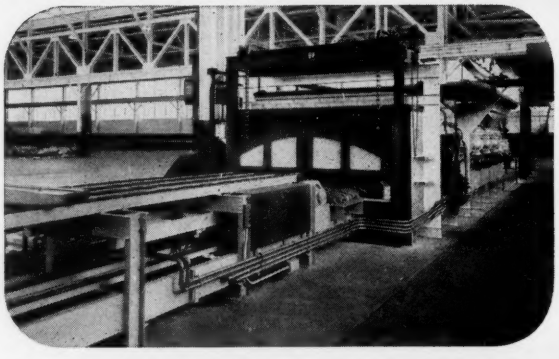
Typical EF Installations

For the utmost in dependable, efficient, low cost service, specify an EF furnace. Built in roller hearth, roller rail, chain belt, car type, wire belt and many other designs. Complete with special atmosphere generators and material handling facilities. Gas fired, oil fired, or electrically heated for any heating or heat-treating operation — any process — any product — and any capacity requirement. Let the EF engineers, with their long and successful experience in engineering and building furnaces, work with you on your next heat treating job.

THE ELECTRIC FURNACE COMPANY
Wilson Street, Salem, Ohio
Gas Fired—Oil Fired and Electric Furnaces



Small parts, headed, drawn, forged or stamped are heat-treated without scale or decarburization—uniformily and economically—in EF chain belt furnaces. Capacities to meet any requirement.

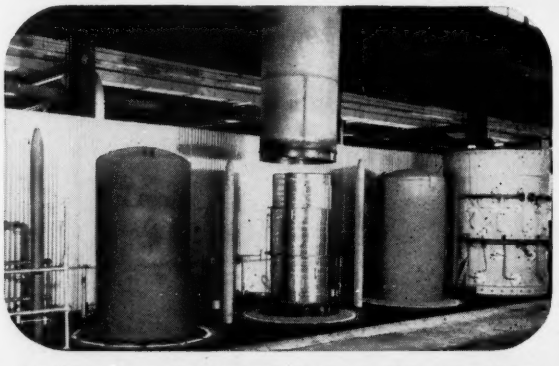


Bars and billets are scale-free heated for rolling, drawing or other processing in EF pusher, rotary and other types of special atmosphere furnaces. Any capacity, atmosphere or temperature.

Continuous annealing of steel strip shortens the heating cycle and improves the drawing qualities. Single or multiple strands to 54" or wider. Capacities to 28,000 lbs. per hour or more.

Nickel-silver and other alloy wire and strip is clean and scale-free annealled in EF furnaces. Furnished complete with special atmosphere and desulphurizing units.

Ferrous and non-ferrous wire on reels, spools, coils and strands is bright annealed uniformly and continuously in EF special atmosphere furnaces. Capacities for any requirement.



Carbon, alloy and non-ferrous wire, strip and other products are annealled, carburized or nitrided in EF bell type furnaces. Cycles readily changed to suit the process.